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For copies of this report, write to:

**Bonneville Power Administration  
Division of Fish and Wildlife - PJ  
P.O. Box 3621  
Portland, OR 97208**

# **UMATILLA SATELLITE AND RELEASE SITES PROJECT**

## **Final Siting Report**

Prepared by:

James M. Montgomery, Consulting Engineers, Inc.  
Bellevue, WA

Prepared for:

Jay Marcotte, Project Manager  
U.S. Department of Energy  
Bonneville Power Administration  
Division of Fish and Wildlife  
P.O. Box 3621  
Portland, OR 97208-3621

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## EXECUTIVE SUMMARY

This report presents the results of site analysis for the Umatilla Satellite and Release Sites Project. The purpose of this project is to provide engineering services for the siting and conceptual design of satellite and release facilities for the Umatilla Basin hatchery program. The Umatilla Basin hatchery program consists of artificial production facilities for salmon and steelhead to enhance production in the Umatilla River as defined in the Umatilla master plan approved in 1989 by the Northwest Power Planning Council. Facilities identified in the master plan include adult salmon broodstock holding and spawning facilities, facilities for recovery, acclimation, and/or extended rearing of salmon juveniles, and development of river sites for release of hatchery salmon and steelhead.

The historic and current distribution of fall chinook, summer chinook, and **coho** salmon and steelhead trout was summarized for the Umatilla River basin. Current and future production and release objectives were reviewed. Twenty seven sites were evaluated for the potential development of facilities. Engineering and environmental attributes of the sites were evaluated and compared to facility requirements for water and space. Site screening was conducted to identify the sites with the most potential for facility development. Alternative sites were selected for conceptual design of each facility type. A proposed program for adult holding facilities, final rearing/acclimation, and **direct** release facilities was developed.

## INTRODUCTION

This report presents the results of site analysis for the Umatilla Satellite and Release Sites Project. The purpose of this project is to **provide** engineering services for the siting and conceptual design of satellite and release facilities for the Umatilla Basin hatchery program. This work was conducted as part of the contract between Bonneville Power Administration (**BPA**) and James M. Montgomery, Consulting Engineers, **Inc. (JMM)**.

The Umatilla Basin hatchery program consists of **artificial** production facilities for salmon and steelhead to enhance production in the Umatilla River as defined in the Umatilla master plan approved in 1989 by the Northwest Power Planning Council. Facilities identified in the master plan include adult salmon broodstock holding and spawning facilities, facilities for recovery, acclimation, and/or extended rearing of **salmon** juveniles, and **development** of river sites for release of hatchery salmon and steelhead.

Preliminary planning for the Umatilla component of spring chinook incubation and rearing facilities identified in the draft master Plan for the Northeast Oregon Hatchery Project (**NEOH**) was subsequently identified as an additional objective of this project. Site analysis for these facilities was taken to a point necessary for environmental analysis purposes. However, final conceptual design of these facilities will be conducted as part of the NEOH project.

This report presents the production goals for the Umatilla Basin, discusses the bioengineering criteria for various facility types, reviews available data on surface water and groundwater availability and quality, reviews existing production facilities and their potential for expansion, and documents the site/facility screening process **carried** out to arrive at a **proposed** program to be carried forward into conceptual design. The report contains the following sections:

Introduction

Current and Historic Distribution of Species

Production and Release Objectives

Fish Propagation Criteria

Water and Space Requirements

Surface Water and Groundwater **Availability** and Quality

Review of Existing Facilities and Assessment of Expansion Capabilities

Site Evaluation and Screening

Program Development

Literature cited

Appendix A - Site Data Sheets.

The majority of the information contained in this report was developed with the assistance of, and review by, the Umatilla River Technical Work Group (TWG), which is comprised of representatives from BPA, Oregon Department of Fish and Wildlife (**ODF&W**), and the **Confederated** Tribes of the Umatilla **Indian Reservation (CTUIR)**.

## CURRENT AND HISTORIC DISTRIBUTION OF SPECIES

The following information on the current and historic distribution of salmon and **steelhead** in the Umatilla Basin has been obtained from the Umatilla River **Subbasin** Salmon and Steelhead Production Plan (**CTUIR** and **ODF&W** 1990). The major spawning and rearing areas are shown on Figure 1.

### SPRING CHINOOK

Although once abundant in the Umatilla Basin, the original stocks of this species were extirpated due to passage blocks, flow diversions from the **mainstem** Umatilla, degradation of headwater habitat and mortalities at **mainstem** Columbia River Dams. An estimated 1,549 acres (54 stream miles) of spring chinook spawning and rearing habitat exists in the Umatilla Basin including **Meacham** Creek to the forks, the upper **mainstem** Umatilla from the Meacham Creek confluence to the North and South forks, and the Umatilla River North and South forks (Figure 1). Return goals for spring chinook salmon are 11,000 adults to the mouth of the river.

### FALL CHINOOK

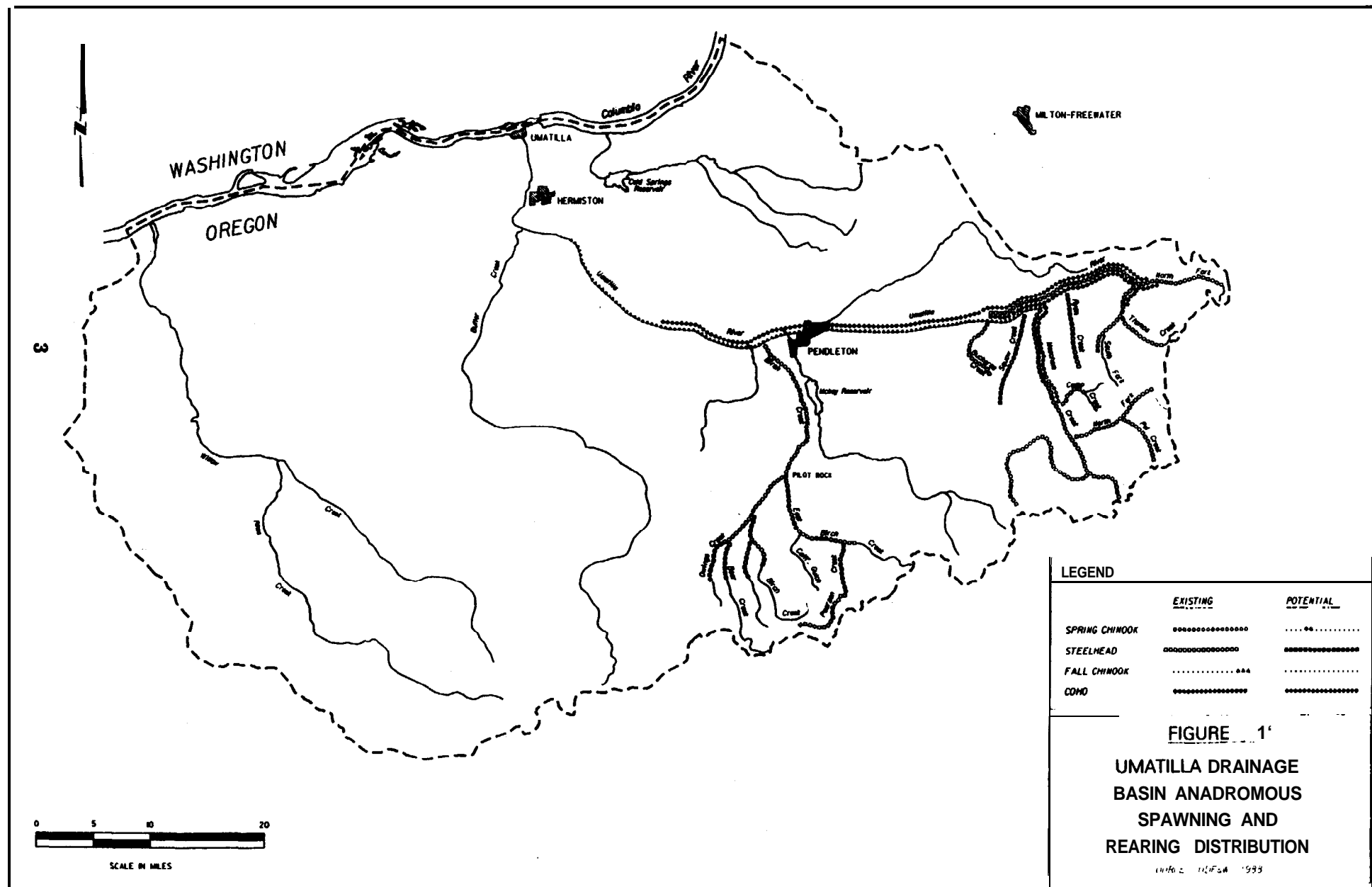
Original stocks of this species have also been extirpated in the Umatilla River. An estimated 5,562 acres (100 stream miles) of fall chinook spawning and rearing exists in the Umatilla **Subbasin** (Figure 1). Potential spawning and rearing **areas** include the **mainstem** Umatilla River to the North and South forks and Meacham Creek to the North Fork. An estimated 85 percent of the fall chinook spawning gravel in the **mainstem** Umatilla is above the city of Pendleton from about RM 55 to RM 88. Return goals for fall chinook salmon are 21,000 adults to the mouth of the river.

### STEELHEAD

The Umatilla River once produced large runs of **summer** steelhead that supported productive tribal and non-tribal fisheries. Current returns to the mouth of the river have been conservatively **estimated** at 2,600 - a fraction of the historical run. An estimated 4,104 acres (314 stream miles) of summer steelhead spawning and rearing habitat exists in the basin. Spawning and rearing areas include Meacham Creek, North Fork Umatilla River, South Fork Umatilla River, upper **mainstem** Umatilla River, Squaw and Birch Creeks, and other small tributary creeks (Figure 1). Return goals for steelhead **are** 9,670 adults to the mouth of the river.

### COHO SALMON

Original stocks of this species have also been extirpated in the Umatilla River. Under terms of the **United States vs Oregon** agreement, 1 million **coho** smolts are released within the Umatilla Basin. Habitat carrying capacity is unknown. Existing distribution includes the Umatilla River **mainstem** from approximately RM 35 to the North and South Forks confluence (Figure 1). **In** addition, potential spawning and rearing areas include the Umatilla **mainstem** from Three Mile Dam to RM 35 and Meacham Creek to the North Fork. Return goals for **coho** are 6,000 adults to the mouth of the river.



## **PRODUCTION AND RELEASE OBJECTIVES**

### **CURRENT PRODUCTION**

Currently, spring chinook, fall chinook, summer steelhead, and **coho** salmon **are** released into the Umatilla Basin. Fish for release in the Umatilla Basin are reared at the Irrigon, Umatilla, Bonneville, Cascade, and Carson hatcheries. Production timetables for those production segments occurring within the basin are presented in Figure 2.

Based on species and size, production scenarios are **summarized** for 11 separate groups of fish in Tables 1 (spring chinook) and 2 (fall chinook, steelhead, and **coho**). Within each group of fish, there may be several subgroups reared under different conditions (pure oxygen vs. conventional rearing) or for evaluation of different release strategies.

### **ADDITIONAL PRODUCTION AND FACILITY NEEDS**

An additional production of 589,000 spring chinook at **10/lb** is identified in the NEOH project Draft Master Plan for the Umatilla Basin. Adult holding, incubation, rearing, and release/acclimation sites needed for this production were evaluated in the site screening process for this project. Preliminary conceptual design of these facilities is included in JMM (1992). Final conceptual design will be conducted as part of the NEOH project.

The fall chinook for the basin are incubated and reared at the Umatilla, Irrigon and Bonneville hatcheries. Additional facilities for adult holding for the fall chinook will be needed as **increaasing numbers** of adults start to return to **the** Umatilla Basin. Identification of a **preferred** site for the fall chinook adult holding facility was a primary objective for this project.

### **POLICY ISSUES**

A broad range of policy issues may influence the development and implementation of the fisheries program for the Umatilla Basin. These include:

- 1) Direct release vs acclimation,
- 2) Out-basin rearing of fry and fingerlings,
- 3) Impact of other fish released in the basin, and
- 4) Impact on other fish in the basin.



**FIGURE 2**



**Table 1**  
**Current and Plumed Production in the Umatilla Basin**  
**for Spring Chinook**

<b>Species</b>	<b>Number Of Adults Needed</b>	<b>Broodstock Source</b>	<b>Smolts Needed</b>	<b>Release Date</b>	<b>Release Sites</b>	<b>Acclimation Sites</b>	<b>Comments</b>
<b>CHS</b> <b>Group 1</b>	450 (1994) 1652 (1995) 2,120 (including NBOH requirement)	Umatilla River (1,000-2,000 currently)	Need rearing facility 589,000 @ 10/#	Spring	Upper Umatilla mainstem	4 needed 400,000 for 30 days	A trap and haul program is used for smolts and adults  In-Basin Facility Needs: Adult Holding, and Spawning Direct Release and Acclimation Sites  In/Out Basin Facility Needs: (for NBOH component) Incubation and Rearing
<b>CHS</b> <b>Group 1</b>	Included Above		Umatilla/Irrigon: 1,080,000 @ 15/#	Spring	Upper Umatilla mainstem and tributaries	Additional sites desirable	In-Basin Facility Needs: Direct Release Sites
<b>Group 3</b>			210,000 @ 5/#	Spring	Upper Umatilla mainstem and tributaries	Additional sites desirable	
<b>CHS</b> <b>Group 4</b>	Included Above		Canon: 100,000 @ 18-20/lb	Spring	Upper Umatilla mainstem and tributaries	None	In-Basin Facility Needs: Direct Release s i
<b>CHS</b> <b>Group 5</b>	Included Above		Bonneville: 200,000 @ 10/#	Spring	Meacham Creek near Bonifer	Bonifer 100,000 for 30 days	In-Basin Facility Needs: None
<b>Group 6</b>			150,00 @ 12/#	Fall	Meacham Creek near Bonifer	Bonifer 75,000 for 30 days	

**TABLE 2**  
**Current and Planned Production in the Umatilla Basin**  
**for**  
**Fall chinook, Steelhead, and Coho**

Species	Number of Adults Needed	Broodstock Source	Smolts Needed	Release Date	Release Sites	Acclimation Sites	Comments
CHF Group 7	5,542 (total program)	Bonn/Priest Rapids  None currently collected in basin  Need holding Facility	Umatilla / Irrigon:  5,940,000 @ 60/#	Spring	Upper Umatilla mainstem	Additional sites desirable	A trap and haul program is used for smolts and adults  In-Basin Facility Needs: Holding and Spawning Direct Release Sites
CHF Group 8  Group 9	Included Above	Same as Above	Bonneville:  910,000 @ 90/lb  150,000 @ 12/lb	Spring  Fall	Umatilla mainstem near Minthorn  Umatilla mainstem near Minthorn	Minthorn (Apr 15-May 20) 455,000 for 30 days  Minthorn (Sep-Oct 30) 75,000 for 30 days	In-Basin Facility Needs: None
STSu Group 10	212 (total program)  Could be as high as 300 using actual pre-spawning mortality	Umatilla River (1,000-2,000 currently)  May need additional holding facility or expansion of existing facilities	Umatilla / Irrigon:  210,000 @ 5/lb	Spring	Umatilla mainstem near Minthorn  Meacham Creek near Bonifer	Minthorn (Mar-Apr 15) 10,500 for 30 days  Bonifer yy,000 for 30 days	In-Basin Facility Needs: A small amount of additional adult holding will be required at Minthorn
Coho Group 11	800	Cascade Hatchery Toutle Stock  None currently collected in basin	Cascade Hatchery  1,000,000 @ 12-17/#	Mar-Apr	Lower Umatilla mainstem	Minthorn	In-Basin Facility Needs: Direct Release and Acclimation Sites  Program will be re-evaluated in future

# FISH PROPAGATION CRITERIA

## INTRODUCTION

The biocriteria proposed for salmon culture for the Umatilla Project are based on similar projects in the Pacific Northwest and discussion with agency and tribal personnel. These criteria will be used for planning level process design and facility layout.

## WATER CHEMISTRY

Fundamental to facility planning is an understanding of various aspects of water chemistry, in both a general and site-specific sense.

### Oxygen

The oxygen content of water used in fish rearing is important because the fish will consume varying amounts of oxygen as they develop. A certain minimum concentration of dissolved oxygen is also required in order to provide an acceptable environment. For these reasons it is desirable to know the approximate dissolved oxygen concentration of the water supply and how it may vary with the degree of gas saturation, temperature, salinity, and site elevation.

The maximum amount of oxygen that can be dissolved in water is referred to as the saturation concentration. The saturation concentration depends on temperature, elevation (or barometric pressure), and salinity. Increasing temperature **decreases** the saturation concentration of oxygen (Table 3). Salinity (total dissolved solids) will have an **insignificant** effect on oxygen solubility at the Umatilla sites.

### Ammonia

Ammonia is produced by fish as a metabolic byproduct. In addition, water supplies often contain ammonia from pollution or natural sources. Fish have a limited tolerance to ammonia under certain conditions. Ammonia is a weak base, and occurs as ionized (**NH<sub>4</sub><sup>+</sup>**) and unionized forms (NH<sub>3</sub>). Un-ionized ammonia moves easily across biological membranes and is generally considered the most toxic of the two forms. The concentration of unionized ammonia in freshwater is primarily a function of **pH** and temperature (Table 4).

### Carbon Dioxide

Fish have limited tolerance to carbon dioxide. Carbon dioxide is produced by fish as a respiratory byproduct, and water supplies often contain high concentrations of carbon dioxide. Under typical conditions, 1.375 mg of carbon dioxide is produced per 1 mg of oxygen consumed. The excretion of carbon dioxide by fish in intensive culture situations (a) increases the dissolved carbon dioxide concentration, (b) reduces the **pH**, and (c) reduces the concentration of unionized ammonia due to the decrease in **pH**. The reduction of **pH** depends on the initial carbon dioxide concentration, alkalinity of the water, and amount of carbon dioxide produced.

**TABLE 3**  
**DISSOLVED OXYGEN AS A FUNCTION OF TEMPERATURE**  
**(2,000 FEET ELEVATION)**

Temp (°F)	DT (°F)									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	.61	.9	13.57	13.55	13.53	13.51	13.49	13.46	13.44	13.42
33	.40	13.38	13.36	13.34	13.32	13.30	13.28	13.26	13.24	13.22
34	13.20	13.17	13.15	13.13	13.11	13.09	13.07	13.05	13.03	13.01
35	12.99	12.97	12.95	12.93	12.91	12.90	12.88	12.86	12.84	12.82
36	12.80	12.78	12.76	12.74	12.72	12.70	12.68	12.66	12.64	12.63
37	12.61	12.59	12.57	12.55	12.53	12.51	12.49	12.48	12.46	12.44
38	12.42	12.40	12.38	12.37	12.35	12.33	12.31	12.29	12.27	12.26
39	12.24	12.23	12.20	12.18	12.17	12.15	12.13	12.11	12.10	12.08
40	12.06	12.04	12.03	12.01	11.99	11.97	11.96	11.94	11.92	11.91
41	11.89	11.87	11.85	11.84	11.82	11.80	11.79	11.77	11.75	11.74
42	11.72	11.70	11.69	11.67	11.65	11.64	11.62	11.60	11.59	11.57
43	11.55	11.54	11.52	11.51	11.49	11.47	11.46	11.44	11.43	11.41
44	11.39	11.38	11.36	11.35	11.33	11.31	11.30	11.28	11.27	11.25
45	11.24	11.22	11.21	11.19	11.17	11.16	11.14	11.13	11.11	11.10
46	11.08	11.07	11.05	11.04	11.02	11.01	10.99	10.98	10.96	10.95
47	10.93	10.92	10.90	10.89	10.87	10.86	10.85	10.83	10.82	10.80
48	10.79	10.77	10.76	10.74	10.73	10.72	10.70	10.69	10.67	10.66
49	10.64	10.63	10.62	10.60	10.59	10.57	10.56	10.55	10.53	10.52
50	10.50	10.49	10.48	10.46	10.45	10.44	10.42	10.41	10.40	10.38
51	10.37	10.35	10.34	10.33	10.31	10.30	10.29	10.27	10.26	10.25
52	10.24	10.22	10.21	10.20	10.18	10.17	10.16	10.14	10.13	10.12
53	10.10	10.09	10.08	10.07	10.05	10.04	10.03	10.02	10.00	9.99
54	9.98	9.96	9.95	9.94	9.93	9.91	9.90	9.89	9.88	9.87
55	9.85	9.84	9.83	9.82	9.80	9.79	9.78	9.77	9.76	9.74
56	9.73	9.72	9.71	9.69	9.68	9.67	9.66	9.65	9.64	9.62
57	9.61	9.60	9.59	9.58	9.56	9.55	9.54	9.53	9.52	9.51
58	9.50	9.48	9.47	9.46	9.45	9.44	9.43	9.41	9.40	9.39
59	9.38	9.37	9.36	9.35	9.34	9.32	9.31	9.30	9.29	9.28
60	9.27	9.26	9.25	9.24	9.23	9.21	9.20	9.19	9.18	9.17
61	9.16	9.15	9.14	9.13	9.12	9.11	9.10	9.09	9.08	9.07
62	9.06	9.05	9.04	9.03	9.02	9.01	9.00	8.99	8.98	8.97
63	8.96	8.95	8.94	8.93	8.92	8.91	8.90	8.89	8.88	8.87
64	8.86	8.85	8.84	8.83	8.82	8.81	8.80	8.79	8.78	8.77
65	8.76	8.75	8.74	8.73	8.72	8.71	8.70	8.69	8.68	8.67
66	8.66	8.65	8.64	8.63	8.62	8.61	8.60	8.59	8.58	8.57
67	8.56	8.55	8.54	8.53	8.52	8.51	8.50	8.49	8.48	8.47
68	8.46	8.45	8.44	8.43	8.42	8.41	8.40	8.39	8.38	8.37
69	8.36	8.35	8.34	8.33	8.32	8.32	8.31	8.30	8.29	8.28
70	8.27	8.26	8.25	8.24	8.23	8.23	8.22	8.21	8.20	8.19

**TABLE 4**

**UN-IONIZED AMMONIA AS A PERCENTAGE OF TOTAL AMMONIA IN FRESHWATER AT VARIOUS TEMPERATURES AND PH**

Temp. C	Temp. F	pH@ 5.0	pH@ 7.0	pH@ 7.1	pH@ 7.2	pH@ 7.3	pH@ 7.4	pH@ 7.5	pH@ 7.8	pH@ 7.7	pH@ 7.8	pH@ 7.9	pH@ 8.0	pH@ 8.1
0.44	40.0	0.00%	0.12%	0.15%	0.19%	0.24%	0.30%	0.37%	0.47%	0.59%	0.75%	0.94%	1.18%	1.48%
5.00	41.0	0.10%	0.12%	0.18%	0.20%	0.25%	0.31%	0.30%	0.49%	0.82%	0.78%	0.08%	1.23%	1.54%
5.55	42.0	0.10%	0.13%	0.15%	0.21%	0.25%	0.33%	0.41%	0.52%	0.55%	0.82%	1.02%	1.29%	1.61%
8.11	43.0	0.11%	0.14%	0.17%	0.22%	0.27%	0.34%	0.43%	0.54%	0.58%	0.85%	1.07%	1.34%	1.69%
8.87	44.0	0.11%	0.14%	0.18%	0.23%	0.28%	0.35%	0.45%	0.55%	0.71%	0.89%	1.12%	1.40%	1.75%
7.22	45.0	0.12%	0.15%	0.10%	0.24%	0.30%	0.37%	0.47%	0.50%	0.74%	0.03%	1.17%	1.47%	1.84%
7.78	45.0	0.12%	0.15%	0.20%	0.25%	0.31%	0.30%	0.40%	0.82%	0.77%	0.07%	1.22%	1.53%	1.02%
8.33	47.0	0.13%	0.18%	0.20%	0.25%	0.32%	0.41%	0.51%	0.84%	0.81%	1.02%	1.28%	1.50%	2.01%
8.89	48.0	0.13%	0.17%	0.21%	0.27%	0.34%	0.43%	0.53%	0.57%	0.85%	1.05%	1.33%	1.57%	2.10%
0.44	40.0	0.14%	0.18%	0.22%	0.28%	0.35%	0.44%	0.55%	0.70%	0.88%	1.11%	1.30%	1.75%	2.10%
10.00	50.0	0.15%	0.10%	0.23%	0.29%	0.37%	0.45%	0.58%	0.73%	0.02%	1.15%	1.45%	1.82%	2.28%
10.55	51.0	0.15%	0.10%	0.24%	0.31%	0.30%	0.48%	0.51%	0.77%	0.05%	1.21%	1.52%	1.90%	2.38%
11.11	52.0	0.18%	0.20%	0.25%	0.32%	0.40%	0.51%	0.54%	0.80%	1.00%	1.28%	1.58%	1.08%	2.49%
11.87	53.0	0.17%	0.21%	0.27%	0.33%	0.42%	0.53%	0.55%	0.83%	1.05%	1.32%	1.55%	2.07%	2.59%
12.22	54.0	0.17%	0.22%	0.28%	0.35%	0.44%	0.55%	0.80%	0.87%	1.00%	1.37%	1.72%	2.15%	2.70%
12.78	55.0	0.18%	0.23%	0.29%	0.38%	0.45%	0.58%	0.72%	0.01%	1.14%	1.43%	1.80%	2.25%	2.82%
13.33	55.0	0.10%	0.24%	0.30%	0.38%	0.48%	0.50%	0.75%	0.05%	1.10%	1.40%	1.87%	2.35%	2.94%
13.80	57.0	0.20%	0.25%	0.31%	0.40%	0.50%	0.53%	0.70%	0.00%	1.24%	1.55%	1.05%	2.45%	3.08%
14.44	58.0	0.21%	0.28%	0.33%	0.41%	0.52%	0.85%	0.82%	1.03%	1.20%	1.52%	2.04%	2.55%	3.10%
15.44	50.0	0.22%	0.28%	0.35%	0.45%	0.55%	0.70%	0.55%	1.11%	1.30%	1.75%	2.10%	2.74%	3.43%
15.44	50.0	0.24%	0.30%	0.38%	0.48%	0.50%	0.78%	0.05%	1.20%	1.50%	1.88%	2.38%	2.95%	3.50%
17.44	51.0	0.25%	0.33%	0.41%	0.52%	0.55%	0.82%	1.03%	1.20%	1.52%	2.03%	2.54%	3.17%	3.98%
18.44	52.0	0.28%	0.35%	0.44%	0.55%	0.70%	0.85%	1.10%	1.39%	1.74%	2.18%	2.73%	3.41%	4.25%

## pH

pH has a major role in determining the toxicity of ammonia, heavy metals, and hydrogen sulfide. The pH of the process water can be changed due to the metabolic activity of the fish and biological filters.

## WATER QUALITY CRITERIA FOR SALMONID REARING

Water quality criteria that provide general guidance in salmonid aquaculture planning are shown on Table 5.

### Minimum Oxygen Levels

The minimum criterion for acceptable dissolved oxygen levels for salmonid culture (as the water leaves the raceways) is:

Fry & Fingerlings

7.0 mg/l

As the incubation temperature increases, dissolved oxygen problems may occur just prior to hatching when dissolved oxygen demand is highest. The critical dissolved oxygen level may be above the local saturation concentration at those times.

### **Ammonia Criteria**

Ammonia is a weak base and exists in ionized ( $\text{NH}_4^+$ ) and un-ionized ( $\text{NH}_3$ ) form. Un-ionized ammonia is more toxic to fish because it can move across biological membranes much faster than the ionized form. Chemical tests measure the amount of total ammonia ( $\text{NH}_4^+ + \text{NH}_3$ ) which is generally expressed as nitrogen (molecular weight = 14.00 **g/mol**). The concentration of un-ionized ammonia depends on total ammonia, **pH**, and temperature. High **pH** and temperature favor the unionized form. Various criteria for the maximum allowable un-ionized ammonia concentration for salmonids range from 0.006 to 0.015 **mg/L** as **NH<sub>3</sub>-N** (Table 5). A recent review of ammonia toxicity (Meade, 1985) concluded that unionized ammonia is probably not the cause of gill hyperplasia, as previously assumed. He also stated that "A truly safe, maximum acceptable concentration of un-ionized, or total, ammonia for **fish** culture systems is not known". For this project, un-ionized ammonia criteria will be set at a concentration not to exceed 0.015 **mg/l**.

### **Carbon Dioxide**

To determine carbon dioxide water quality criteria, it is also necessary to define critical levels. Recently, Riper et al. (1982) proposed an upper limit concentration of 10 **mg/l**, although others have suggested up to 20 **mg/l** (SECL, 1983). For Umatilla planning 10 **mg/l** will be used as the carbon dioxide criterion. The carbon dioxide criteria may also depend on the relationship between carbon dioxide, alkalinity, and **pH**.

### **pH**

Criteria for **pH** depend on species, life stage, and ionic composition of the water. For incubation and early fry rearing, SECL (1983) recommended that the **pH** be maintained between 6.5 - 8.5. This range will be used for Umatilla planning.

**TABLE 5**  
**WATER QUALITY CRITERIA FOR SALMONIDS**

Parameter	ADF&G <sup>1</sup>	SEP <sup>2</sup>	WDF <sup>3</sup>	USFWS <sup>4</sup>
Alkalinity	undetermined	>15		10-400
Aluminium	<0.01	<0.10	<0.01	
Ammonia (total as N)		<0.05		
Ammonia (un-ionized as N)	<0.010		0.010	<0.010
Arsenic	<0.05		<0.05	<0.05
Barium	<5.0		<5	<5
Cadmium < 100 mg/L Alkalinity	<0.0005	<0.0003	<0.0002	<0.0004
> 100 mg/L Alkalinity	<0.005			<0.003
Carbon Dioxide	<1.0	<10	<1	0-10
Chloride	<4.0			<4
Chlorine	<0.03			<0.03
Chromium	<0.03	<0.04	<0.01	<0.03
Copper < 100 mg/L Alkalinity	<0.006	<0.0002	<0.05	<0.006
> 100 mg/L Alkalinity	<0.03			
Dissolved Oxygen - mg/L (%)	>7.0	(>95)		(95-100)
Fluoride	<0.5		<0.5	<0.5
Hydrogen Sulfide	<0.003	<0.002	<0.003	<0.002
Hardness		>20	<200	10-400
Iron	<0.1	<0.3	<0.1	<0.15
Lead	<0.02	<0.004	<0.02	<0.03
Magnesium	<15		<15	needed
Manganese	<0.01	<0.1	<0.01	<0.01
Mercury	<0.0002	<0.0002	<0.0002	<0.00005
Nickel	<0.01	<0.045	<0.01	<0.01
Nitrogen Gas (%)	<103		<110	<110
Nitrate as N	<0.2		<0.2	0-0.7
Nitrite as N	<0.03	<0.015	<0.03	<0.03
Ozone				<0.005
PCBs				<0.002
Petroleum (Oil)	<0.001			
pH (units)	6.5-8.0	7.2-8.5	6.5-8.0	6.5-8.0
Potassium	<5.0		<5	<5
Salinity (mg/kg)	<5.0			
Selenium	<0.01	4.050	<0.002	<0.01
silver	<0.003	<0.0001	4.003	<0.003
Zinc	4.005		<0.005	<0.03
Sodium	<75		<75	<75
Sulfate	<50		<50	<50
Suspended Solids		<3		
Temperature (°C)	0-15	5-10		
Total Dissolved Solids	<400			
Total Settleable Solids	<80			<80
Total Gas Pressure (%)	<110	<103		

All units mg/L unless otherwise noted

- (1) ADF&G 1983.
- (2) Shepherd 1984.
- (3) Schroeder 1989.
- (4) Piper et al. 1982.



## **PROCESS CRITERIA**

Process criteria serve as the basis for detailed design and layout. These criteria have been developed from similar projects and may change during the conceptual design stage and later planning as further input is received

### **General Process Criteria**

Process criteria for the Umatilla Satellite Project are presented in Table 6. Information is presented for:

- Adult Hauling,
- Adult Holding,
- Spawning,
- Incubation,
- Early Rearing,
- Rearing,
- Fry Hauling,
- **Smolt** Hauling,
- Direct Release, and
- Extended Rearing/Acclimation.

### **Length-Weight Relationship**

It is necessary to relate the weight of the fish at any time to their individual lengths. This is expressed as follows:

$$W = C \times L^3$$

where W = weight in pounds, L = length in inches, and C is the condition factor for the species in question.

### **Development Rate**

Eggs: The development rate of the eggs is based on the number of degree days above 32 °F.

Fry: The development rate is based on the number of degree days to achieve an inch of growth.

**TABLE 6**  
**PROCESS CRITERIA FOR THE UMATILLA BASIN**

Parameter	Spring Chinook	Fall Chinook	Summer Steelhead
	Group 1	Group 7	Group 10
<b>Adult Hauling</b>			
Date	Apr 15-Jul 15	Sep-Dec	Oct-May
Weight (lb)	13	15	6
Duration (hr)			
DI			
<b>Adult Holding</b>			
Date	Apr 15-Jul 15	Sep-Dec	Oct-May
Weight (lb)	13	15	6
Temperature (F)			
Optimum	45-55	45-55	40-55
Peak maximum diurnal flux	60-65	60-65	55-60
Density (cf/fish)	8	7	2.5
Flow (gpm/fish)	-1.5 + 0.05xT	-1.5 + 0.05xT	-0.5 + 0.05xT
Survival (%) (Capture-Spawning)	75	80	75
<b>Spawning</b>			
Date	Aug 5-Sep 15	Oct 15-Dec	Mar 15-May
Female/Male Ratio	1:1	1:1	1:1
Eggs/female	4,200	4,500	5,200
<b>Incubation</b>			
Date	Aug-Dec	Oct 15-Feb	Mar 15-Jun
Eggs/Tray (1 female/tray)	4,200	4,500	5,200
Flow/8 trays (gpm)	6	6	6
Time to Hatch 50F(d)	93	93	54
Temperature(F)			
Optimum	42->39->42 <sup>a</sup>	52	52
Range	45-55	45-55	45-55
Maximum	55	55	55
Survival (green egg to feeding)	90	90	90
DD to Feeding	1665	1665	975
Length at Feeding (inches))	1.34	1.45	1.02
Weight at Feeding (#/lb)	1100	1100	2800

<sup>a</sup> This temperature **profile** may be used to delay the development of the eggs

**TABLE 6 (continued)**

Parameter	Spring Chinook	Fall Chinook	Summer Steelhead
	Group 1	Group 7	Group 10
<b>Length-Weight (<math>W = CW^n</math>, inches, lb)</b>			
C	$2,959 \times 10^{-7}$	$2.959 \times 10^{-1}$	$3,405 \times 10^{-7}$
n	3.00	3.00	.00
<b>Early Rearing (Feeding to 200/lb)</b>			
Date	Nov-Feb	Jan-Mar	May-Jul
Length at Start (inches)	1.34	1.45	1.02
Weight at Start (#/lb)	1100	1100	2800
Duration (d) @ 50F	32	32	64
Temperature (F)			
Optimum	50	50	50
Range	40-60	40-60	40-60
Maximum	65	65	65
DI	1.00	1.00	1.00
FI (based on Table 13)	Table 13	Table 13	Table 13
Survival (%)	90	90	90
DD /inch	840	840	810
Length at End (inches)	2.57	2.57	2.45
Weight at End (#/lb)	200	200	200
<b>Rearing (200/lb to Transport)</b>			
Date	Dec-May 15	Jan-May 15	May-Apr
Length at Start (inches)	2.57	2.57	2.45
Weight at Start (#/lb)	200	200	200
Duration (d) @ 50F	205	36	266
Temperature (F)			
Optimum	55	55	55
Range	45-65	45-65	45-65
Maximum	70	70	70
DI	0.8	0.8	0.8
FI (based on Table B)	Table 13/1.25	Table 13/1.25	Table 13/1.25
Survival (%)	92	92	92
DD/inch	840	840	810
Length at End (inches)	6.97	3.35	8.37
Weight at End (#/lb)	10	65	5
<b>Egg-Smolt</b>			
Survival (%)	72	75	75

**TABLE 6 (continued)**

Parameter	Spring chinook	Fall Chinook	Summer Steelhead
	Group 1	Group 7	Group 10
<b>Smolt Hauling</b>			
Date	Mar-May 15	Apr-May 15	Mar-Apr
Length (inches)	6.97	3.35	8.37
Weight (#/lb)	10	65	5
Duration (hr)			
DI			
Survival (%)	99.5	99.5	99.5
<b>Direct Releases</b>			
Distance between sites	3-8	3-8	3
Length of river reach	17	8	undefined
Number of Fish/Release Site/Mile/Week	varies	varies	varies
<b>Extended Rearing/Acclimation Ponds</b>			
Date	Mar-May 15	Apr-May 15	Mar-Apr
Distance between Sites	>5	>5	>5
Length at Start (inches)	6.54	2.83	7.80
Weight at Start (#/lb)	12	65	5.5
Duration (d)@ 55F	3 to 30	3 to 30	3 to 30
DI	0.11	0.11	0.11
FI (based on Table 13)	Table 13/1.25	Table 13/1.25	Table 13/1.25
Survival (%)	99.5	99.5	99.5
DD/inch (Rearing value increased by 50%)	1260	1260	1215
Length at End (inches)	6.97	3.35	8.37
Weight at End (#/lb)	10	60	5

## Feed Consumption

The amount of food to be fed to the fish must be known in order to predict oxygen demand, ammonia concentrations, and suspended solids production levels. Generally, the daily feeding rate is determined from information provided by feed companies or as summarized in Piper et al. (1982). This information **can be** converted to simple feeding coefficients (Fc) that relate feeding rate **to** water temperatures and growth rate.

TABLE 7

### FEEDING COEFFICIENT AT VARIOUS WATER TEMPERATURES (a)

Temperature (°F)	Feeding Coefficient (b)
46	7.38
49	8.54
52	9.70
5	10.86
58	12.02

- (a) Based on feeding rates presented in Table 25 of Piper et al. (1982) for fish growing at 909 **DD/inch** length increase.  
(b) Feeding Coefficient = (**Water** temperature [°F] - 26.94) x 0.387

To determine the daily amount of feed offered to fish, one would use the formula:

$$\% \text{ of Body Weight to Feed} = Fc/L$$

Where Fc is the feeding **coefficient**, and L is the length of fish in inches.

## Oxygen Consumption

The calculations of oxygen levels and consumption will be based on the following relationship between feed (F) and oxygen consumption in raceways (**Oc**):

$$Oc = 0.25 \times F$$

Stated in another way, for each 100 pounds of food introduced **to** a raceway, **25** pounds of oxygen will be consumed in that raceway in the same period of time. This is probably conservative in that a general value of **Oc=0.22** x F was proposed by Willoughby for a dry diet. Values of Oc ranging **from** 0.22 to 0.25 are probably valid for fingerlings under production conditions. Higher values may be needed for smaller fish and for fry and fingerlings fed restricted rations.

### **Ammonia Production**

The calculation of ammonia production is based on the following relationship between feed (**F**) and total ammonia produced, TAN (total ammonia expressed as nitrogen):

$$\text{TAN} = 0.029 \times \text{F}$$

This relationship is based on work by Liao and Mayo (1974) at the Cowlitz Trout Hatchery and **verified** by other sources.

### **Carbon Dioxide**

As proposed by Piper et al (1982) the dissolved carbon dioxide produced per pound of feed will be based on the following relationship between feed (**F**) and carbon dioxide production (**Cp**):

$$\text{Cp} = 0.28 \times \text{F}$$

### **Suspended Solids**

Suspended solids sources in the effluent of a production unit consist of materials in the **influent** water, fecal solids, uneaten feed, and other materials that have fallen or have been blown into the water. Pollution control requirements may be based in part on effluent suspended solids (**SuS**) levels. The calculations of **SuS** generated will be based on the following relationship between feed (**F**) and total **SuS**:

$$\text{SuS} = 0.35 \times \text{F}$$

Because of the number of materials that can contribute to suspended solids, operational considerations, and site-specific factors, the above relationship may not be valid for all locations.

### **Phosphate**

Phosphate sources in intensive culture include uneaten feed, fecal matter, and direct excretion from the kidneys. The amount of phosphates added to the water also depends on the type of solids removal system used. Commonly, the amount of phosphate added to the diet is in excess of that needed by the fish. Because of discharge restrictions on phosphate in North America and Europe, major research has been directed towards the reduction in the amount of phosphate in the diet and development of operational procedures to reduce the phosphate concentration in the discharge water. Based on work reported by **Liao** and Mayo (**1974**), the phosphate production rate will be based on the following relationship between feed (**F**) and total P04:

$$\text{P04} = 0.016 \times \text{F}$$

### **Rearing Mortalities**

To develop a hatchery model, it is necessary to have an estimate of mortalities that may be expected in the facility. Typically, survival is lowest at the beginning of a cycle and highest at the end. Survival assumptions for Umatilla are shown on Table 8:

**TABLE 8****ASSUMED SURVIVAL RATES BY LIFE STAGE AND SPECIES**

Life Stage	Spring Chinook	Fall Chinook	Summer Steelhead
Capture-Spawning	75	80	75
Eggs-Smolt	72	75	75
Eggs-Feeding	90 (assumed)	90 (assumed)	90 (assumed)
Feeding-200/#	90 (assumed)	90 (assumed)	90 (assumed)
200/#-Release	92 (assumed)	92 (assumed)	92 (assumed)
Smolt Hauling	99.5 (assumed)	99.5 (assumed)	99.5 (assumed)
Acclimation Ponds	99.5 (Assumed)	99.6 (Assumed)	99.5 (Assumed)

**Rearing Density**

Density criteria (maximum weight of fish per cubic foot) is developed in terms of the Density Index approach. The Density Index (**DI**) is:

$$DI = \frac{\text{Fish density (lb/ft}^3\text{)}}{\text{Length of fish (inches)}}$$

or

$$\text{Density (lb/ft}^3\text{)} = DI \times \text{length in inches}$$

Detailed information on **DIs** for a number of similar projects is shown on Tables 9 and 10.

TABLE9

**DENSITY AND FLOW INDICES USED BY DIFFERENT AGENCIES IN THE PACIFIC  
NORTHWEST FOR OUTDOOR RACEWAYS (>800/LB.)**

<b>Agency/Project</b>	<b>Density Index (lb/(cf•in))</b>	<b>Flow Index (lb/gpm•in) (a)</b>
<b>WDF&amp;W</b> Design Values (Based on FMC, 1984)	0.22-0.30(mean=0.20)	5
<b>WDF&amp;W</b> (Recent Hatcheries)		
Willamette (standard)	0.16 (max)	50
Umatilla (ChS)	0.16 (max)	78
Umatilla (ChF)	0.17 (max)	83
<b>WDF</b> Design Values	undetermined	100
<b>WDF</b> (Recent Hatcheries)		
Issaquah (chinook)	0.08 (max)	96
Lyons Ferry (ChS)	0.03-0.23 (mean = 0.10)	60
Lyons Ferry (ChF)	0.06-0.27 (mean = 0.16)	60
<b>Yakima/Klickitat</b> Production Design Values	0.176 raceways (max) 0.160 ponds (max) 0.110 acclimation ponds (max)	4 (available O <sub>2</sub> , mg/l) ----- (% food fed)(length, in.) (b)
<b>US Fish &amp; Wildlife Service</b>		
Dworschak National Fish Hatchery (Steelhead)	0.26(max)	---
Makah National Fish Hatchery (Fall Chinook)	0.60 (max)	----
Piper et al., 1982 (Salmon and Trout)	0.50 (max)	100
<b>Bonneville Power Administration</b> (Assessment of Present Anadromous Fish Production . . . . 1990)	0.26 chs (max) 0.30 ChF(max) 0.25 Steelhead (max)	109

(a) Percent of Table 8, Piper et al. (1982).

(b) Depending on specific rearing cycle and temperatures, the **FI**s computed from this equation range from **110-130%** of the values shown on Table 8, Piper et al. (1982).



**TABLE 10**

**DENSITY AND FLOW INDICES USED BY VARIOUS AGENCIES IN THE PACIFIC  
NORTHWEST FOR EARLY-G (<800/LB.)**

<b>Agency/Project</b>	<b>Density Index (lb/(cf•in))</b>	<b>Flow Index(lb/gpm•in) (a)</b>
South Tacoma Hatchery Rainbow Trout	<b>01.5-1.7</b>	<b>65-86</b>
Cowlitz Hatchery Steelhead and Cutthroat	<b>2.3-2.5</b>	<b>104-114</b>
Mossyrock Hatchery Rainbow Trout	Similar to Cowlitz	Similar to Cowlitz

(a) Percent of Table 8, Piper et al. (1982).

For Umatilla, the following **DIs** are proposed for planning purposes (Table 11):

**TABLE 11**

**PROPOSED DENSITY INDICES BY LIFE STAGE FOR Umatilla**

<b>Phase</b>	<b>Density Index (lb/cf•in)</b>
Early Rearing	1.00 (possibly up to 2.99 depending on feeding response)
Rearing in Raceways	0.17
Acclimation in Raceways	0.17
Acclimation in Earthen Ponds	0.11
Acclimation in Large Earthen Ponds	no information available
Acclimation in Side Channels	no information available

## Flow Requirements

The water requirements in an intensive culture salmon hatchery are determined by six factors: (1) The amount of oxygen consumed, (2) the oxygen levels in the **influent** water supplied to the raceways, (3) tolerance to lowered oxygen levels, (4) ammonia in the incoming water supply, (5) metabolites, primarily ammonia, carbon dioxide, and suspended solids, produced in the rearing process, and (6) tolerance to the metabolites, specifically **un-ionized** ammonia, carbon dioxide and suspended **solids**. In turn, oxygen consumption and metabolite production is directly related to the amount of feed.

Flow requirements for adult holding as a function of temperature (**°F**) are based on Senn et. al. (1984) and are shown on Table 12.

TABLE 12

### FLOW REQUIREMENTS AS A FUNCTION OF TEMPERATURE (T)

Species	gpm/fish
Spring Chinook	$-1.5 + 0.05T$
Fall Chinook	$-1.6 + 0.05T$
Summer Steelhead	$-0.5 + 0.05T$

Loading criteria for rearing (pounds of fish per gallon per minute) are developed in terms of the Flow Index approach. The Flow Index (**FI**) is:

$$FI = \frac{\text{Loading (lb/gpm)}}{\text{Length of fish (inches)}}$$

or

$$\text{Loading (lb/gpm)} = FI \times \text{length in inches}$$

The flow indices proposed for Umatilla are shown on Table 13 and are based on Piper et al. (1982). For rearing and acclimation, Piper's values are derated by a factor equal to 1.25. Therefore, more water is required compared to Piper's table.

TABLE 13

**FLOW INDEX RELATED TO WATER TEMPERATURE AND ELEVATION**

Temp (°F)	Elevation (Feet)									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
40	2.70	2.61	2.54	3.43	2.34	2.25	2.16	2.09	2.01	1.94
41	2.61	2.52	2.44	2.35	2.26	2.18	2.09	2.02	1.94	1.87
42	2.52	2.44	2.35	2.27	2.18	2.10	2.02	1.95	1.88	1.81
43	2.43	2.35	2.27	2.19	2.11	2.03	1.94	1.88	1.81	1.74
44	2.34	2.26	2.18	2.11	2.03	1.95	1.87	1.81	1.74	1.68
45	2.25	2.18	2.10	2.03	1.95	1.88	1.80	1.74	1.68	1.61
46	2.16	2.09	2.02	1.94	1.87	1.80	1.73	1.67	1.61	1.55
47	2.07	2.00	1.93	1.86	1.79	1.73	1.66	1.60	1.54	1.48
48	1.98	1.91	1.85	1.78	1.72	1.65	1.58	1.53	1.47	1.42
49	1.89	1.83	1.76	1.70	1.64	1.58	1.51	1.46	1.41	1.36
50	1.80	1.74	1.68	1.62	1.56	1.50	1.44	1.39	1.34	1.29
51	1.73	1.67	1.62	1.56	1.50	1.44	1.38	1.34	1.29	1.24
52	1.67	1.61	1.56	1.50	1.44	1.39	1.33	1.29	1.24	1.19
53	1.61	1.55	1.50	1.45	1.39	1.34	1.29	1.24	1.20	1.15
54	1.55	1.50	1.45	1.40	1.34	1.29	1.24	1.20	1.16	1.11
55	1.50	1.45	1.40	1.35	1.30	1.25	1.20	1.16	1.12	1.07
56	1.45	1.40	1.35	1.31	1.26	1.21	1.16	1.12	1.08	1.04
57	1.41	1.36	1.31	1.27	1.22	1.17	1.13	1.09	1.05	1.01
58	1.36	1.32	1.27	1.23	1.18	1.14	1.09	1.05	1.02	0.98
59	1.32	1.28	1.24	1.19	1.15	1.10	1.06	1.02	0.99	0.95
60	1.29	1.24	1.20	1.16	1.11	1.07	1.03	0.99	0.96	0.92
61	1.25	1.21	1.17	1.13	1.08	1.04	1.00	0.97	0.93	0.90
62	1.22	1.18	1.14	1.09	1.05	1.01	0.97	0.94	0.91	0.87
63	1.18	1.14	1.11	1.07	1.03	0.99	0.95	0.92	0.88	0.85
64	1.15	1.12	1.08	1.04	1.00	0.96	0.92	0.89	0.86	0.83

NOTE: Based on optimum index of FI = 1.5 at 50F and 5,000 Feet Elevation. Oxygen Concentration is Assumed to be at or Near 100% Saturation (Piper et al., 1982).

## **WATER AND SPACE REQUIREMENTS**

The potential facilities that may be necessary to satisfy both the production goals and biological requirements of the **Umatilla** Satellite and Release Sites program have been evaluated. These preliminary descriptions and design criteria were utilized for analyzing the candidate sites for available land area, water supply, water quality, and major institutional issues.

The following information defines, as necessary for the preliminary **screening** of alternative sites, several critical factors that are required to evaluate the options. The space shown for overall size of facilities is in the form of a schematic flow diagram versus a **detailed** layout. The criteria presented **are based** upon information developed by **BPA, ODF&W, CTUIR** and the JMM team.

### **ADULT CAPTURE FACILITIES**

#### **Location**

**ChS:** existing facility at Three Mile Dam as the first option. **As returns increase, capture** sites on Umatilla River above Meacham Creek but below Corporation, such as the **Fred Gray** site, are options.

**ChF:** existing facility at Three Mile **Dam**

#### **Schedule**

**ChS/ChF:** April 15 through December

#### **Minimum Flow Necessary**

10 cfs

#### **Existing Facilities**

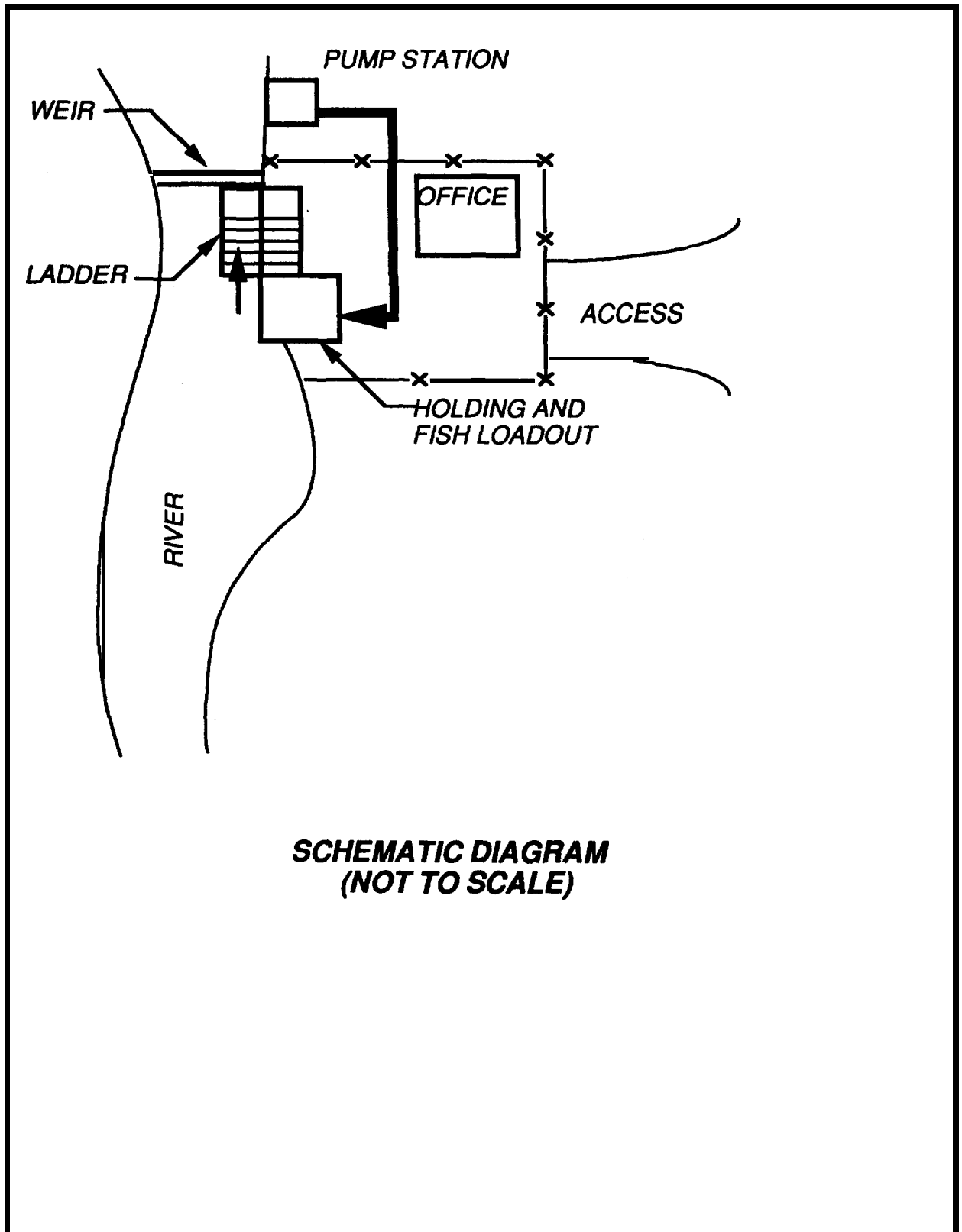
##### **3 Mile Dam**

Bonifer  
Mintholn

#### **Facilities Necessary or Desirable for Adult Capture**

1. **Weir**
2. **Ladder**
3. Holding (short-term)
4. Security (Personnel on-site during operations, security guard **during** holding).
5. Small office/storage
6. Small trailer for personnel

A generic layout of an adult capture facility is shown on Figure 3.



**ADULT CAPTURE FACILITIES  
FIGURE 3**

## ADULT HOLDING

### Number of Fish (Total)

ChS 1,652 (current), 2,759 (current plus Umatilla and Walla Walla NEOH components)  
ChF 5,542  
StSu 212 to 300 (use 300) at existing Bonifer & Minthorn facilities

### Temperature and Flows Required (total program)

<u>Temperature</u>	<u>Flow ChS(gpm)</u>	<u>Flow ChF(gpm)</u>	<u>Flow StS(gpm)</u>
50°F			600
55°F	2,759	6,928	675
60°F	4,139	8,313	750

At 50°F assume 1 gpm/fish and an additional 5% of flow for each degree above 50°F

### Holding Area Required (cubic feet)

	<u>Unit (cf/fish)</u>	<u>Total (cf)</u>
ChS	8	22,072
ChF	7	39,000
StS	2.5	750

### Schedule

	<u>Period</u>
ChS	April 15 October 1
ChF	September-December
StSu	October - May

### Maximum Holding Capacity Required

Maximum holding capacity for ChF would be approximately 39,000 cf for 5,542 fish. Maximum holding capacity for ChS would be approximately 22,072 cf for 2,759 fish.

If ChF are held at the same facility as ChS during warm years there would be an approximate 4-week period of overlap in September where approximately 1,000 fish would be held at the same facility. The maximum volumes listed above will accommodate this overlap.

### Summary

Maximum Volume Required: ChF: 39,000 cf, ChS: 22,000 fish.  
Maximum Sustained Temperature: 55°F  
Maximum Flow Required: ChF: 6,928 gpm, ChS: 3,449 gpm.

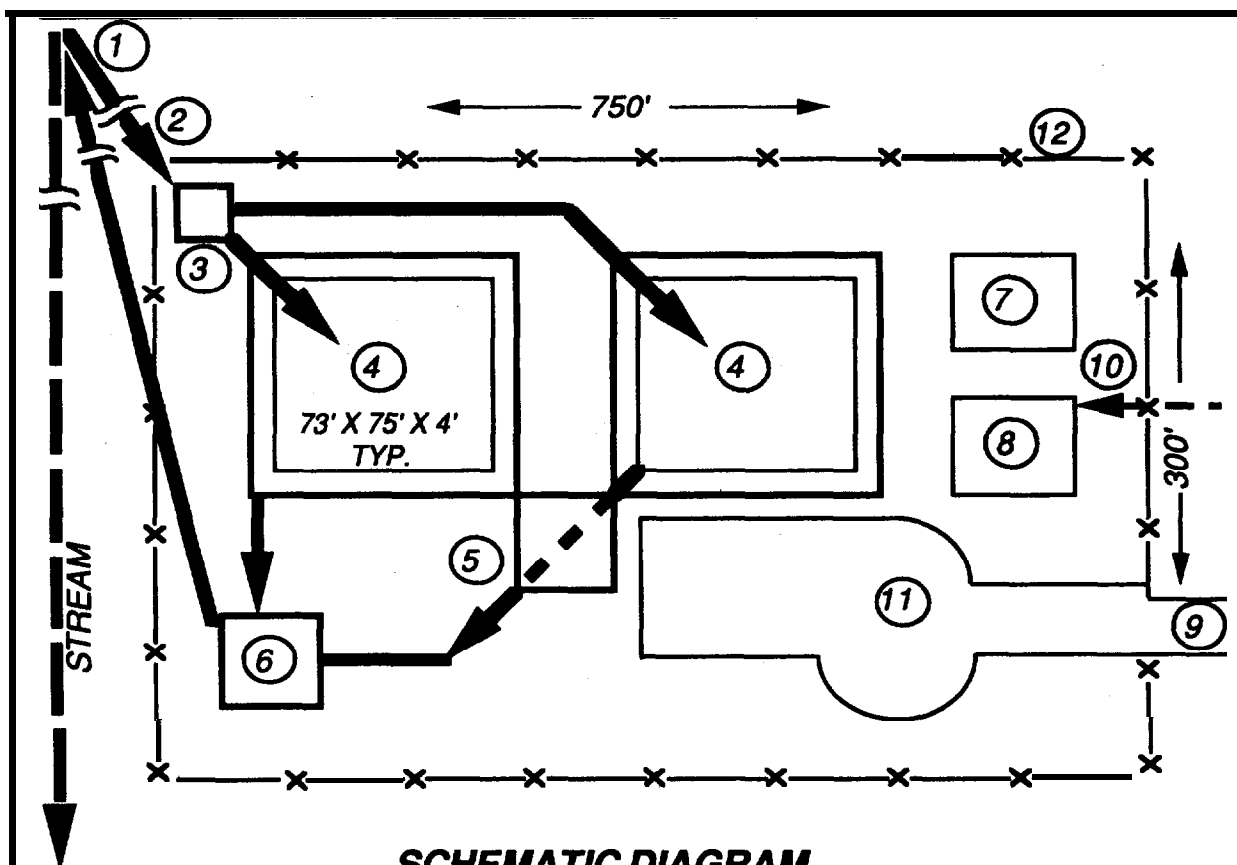
### **Facilities Necessary or Desirable for Adult Holding**

1. Water supply
2. Ponds or Raceways (2 min)
3. **Office/storage**
4. **Sanitary** facilities
5. Utilities
6. carcass Disposal
7. Limited bunk house
8. **Security**
9. Access
10. Effluent discharge / water treatment
11. Egg **taking** station

### **Assumed Size (General) for Complete Facility Layout**

**5 acres**

A generic layout of an adult holding facility is **shown** on Figure 4.



**SCHEMATIC DIAGRAM  
(NOT TO SCALE)**

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| ① INTAKE STRUCTURE                    | ⑦ 7 PERSONNEL FACILITIES (HOUSING) |
| ② PIPELINE, INFLUENT                  | ⑧ OFFICE/STORAGE                   |
| ③ WATER HEADWORKS                     | ⑨ ACCESS                           |
| ④ PONDS/RACEWAYS ETC.                 | ⑩ 10 ELECTRICAL POWER              |
| ⑤ EGG TAKE STATION                    | ⑪ PARKING/TRAFFIC CONTROL          |
| ⑥ EFFLUENT TREATMENT AND PUMP STATION | ⑫ 12 SECURITY                      |

**ADULT HOLDING FACILITY  
FIGURE 4**



## INCUBATION AND EARLY REARING

### Definition

Incubation and early rearing is defined as rearing of fish from green eggs to **200/pound**.

### Number of Eggs

1 million

### Early Rearing Fish

(200/lb) - 4,050 total lbs

### Schedule

Incubation will occur from August - June, or stated by species:

	<u>Period</u>
ChS	August - December
ChF	<b>October 15</b> - February
StSu	March 15 - June

Early rearing will occur **from** November - July, or stated by species:

	<u>Period</u>
ChS	November - February
ChF	January-May 15
StSu	May - July

### Temperature and Flows Required (total program)

#### Incubation

Maximum Water **Temperature: 55°F**

Water **Temperature** Range: 45 to **55°F**

Design flow: 200 gpm (25 stacks of 8 trays @ 8 gpm)

#### Early Rearing

Maximum Water **Temperature: 55°F**

Water Temperature Range: 45 to **56°F**

Design Flow:

FI = 1.35, (**55°F/3,000** ft elevation)

Loading = 3.47 **lb/gpm**

1,200 gpm

Density

DI = 1.0

D = 2.47 **lb/ct**

Volume = 1600 cf

### Water Source

**Groundwater** (first priority)

Disinfected Surface Water (second priority)

### **Facility Size (generic)**

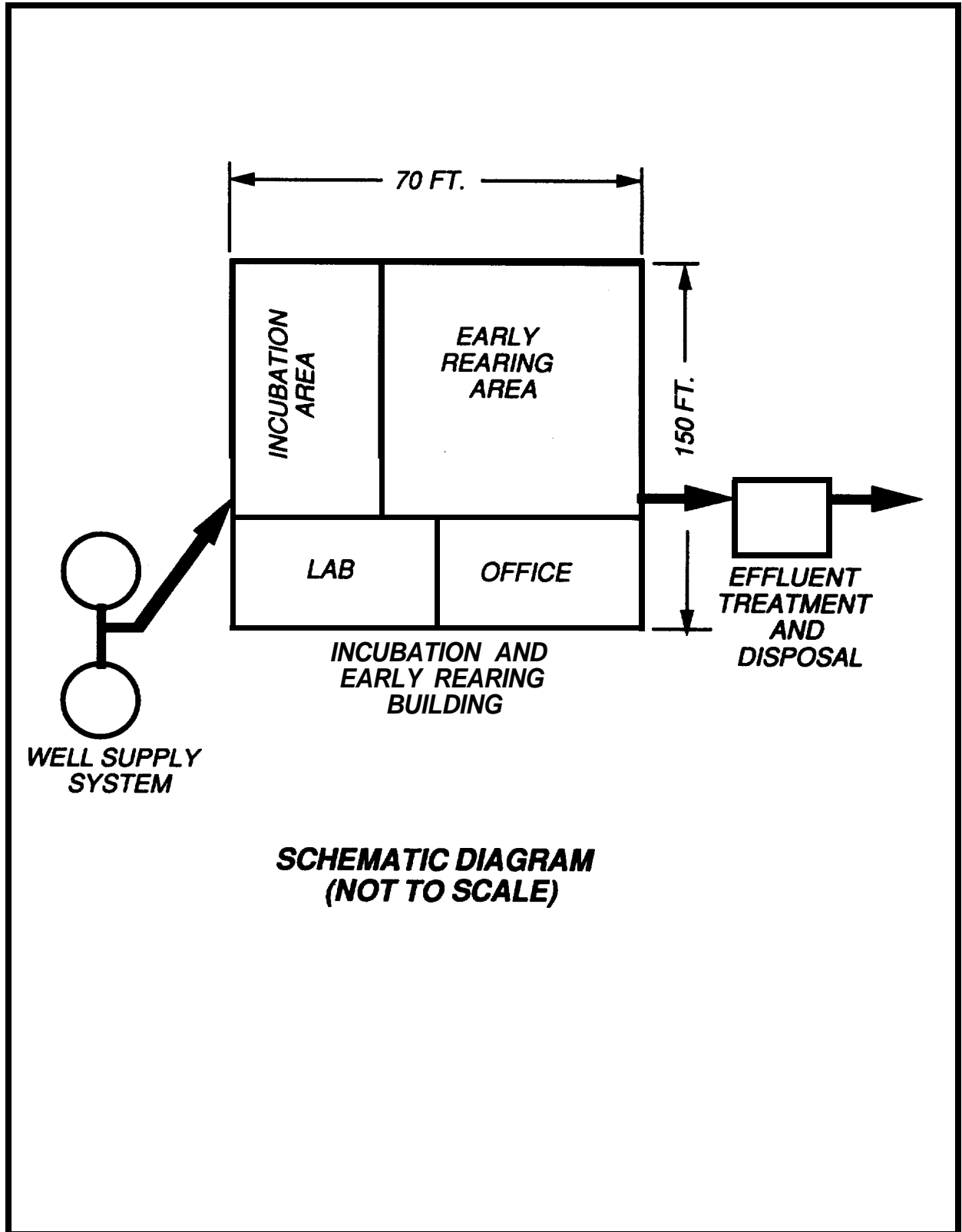
1 acre (max.)

### **Facilities Necessary or Desirable for Incubation/Early Rearing**

1. Groundwater supply (1 st option)
2. Disinfection facilities (secondary option)
3. Loading facility
4. Incubation mom (controlled **environment**)
5. **Office lab area**
6. Personnel facilities
7. Sanitary facilities
8. Early **rearing** facilities
9. Effluent disinfection

Incubation and early rearing should be attached to other facilities, such as rearing and adult holding sites, so that **infrastructure** would be in place.

A generic layout of an **incubation** and early **rearing** facility is shown on Figure 5.



**INCUBATION AND EARLY REARING  
FIGURE 5**

## **SATELLITE (FULL TERM) REARING**

### **Definition**

Satellite rearing is defined as **rearing** of fish **from 200/pound** to release.

### **Total Number of Fish**

**ChS 589,000 (to 10/lb.).** This number represents the Umatilla component of the NEOH program.

### **Temperature and Flows Required (total program)**

Maximum flows: 9,375 gpm (8 lb/gpm)

Critical Flow : (summer) 6,000 gpm at temperatures less than **60°F**

### **Schedule**

Rearing **Period:** 12 months

Schedule: April to May release

Initial **size:** 200/lb

### **Area Required**

Density: 1.18 lb/ft<sup>3</sup> (DI = 0.17)

Pounds: 58,900 (10/lb)

Volume **Required:** 50,000 cf

### **Summary**

Maximum Holding Area **Required:** 50,000 cf

**Temperature** Range: 45-65°F

Peak **Maximum diurnal temperature:** 60-65°F

Maximum Flow **Required:** 21 cfs

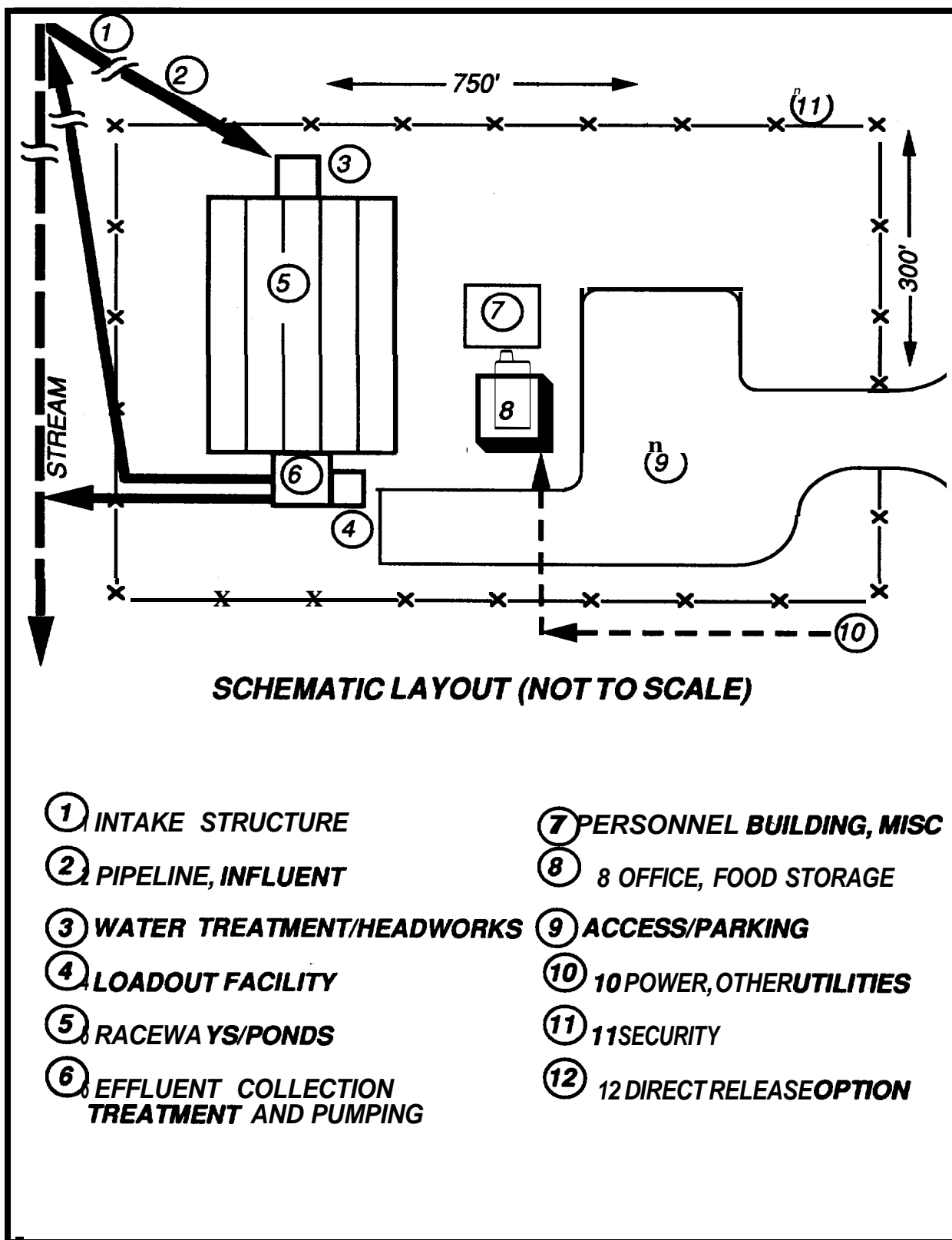
**Maximum Summer** critical Flow: 14 cfs

### **Facilities Necessary or Desirable for Satellite Rearing**

1. Water supply
2. **Water treatment**
3. Loading facilities
- 4: **Office/storage/lab**
5. Personnel facilities
6. Raceways/ponds
7. **Sanitary** facilities
8. Access
9. Utilities
10. **Security**
11. Effluent water treatment and return

### **Assumed Size of a Complete Facility**

5 acres. A generic layout of a satellite rearing facility is shown on Figure 6.



**SATELLITE REARING FACILITIES  
FIGURE 6**

## **DIRECT RELEASE**

### **Number of Fish**

10 million assumed for full program **direct release**

### **Site Locations**

3 to 8 river miles between sites.

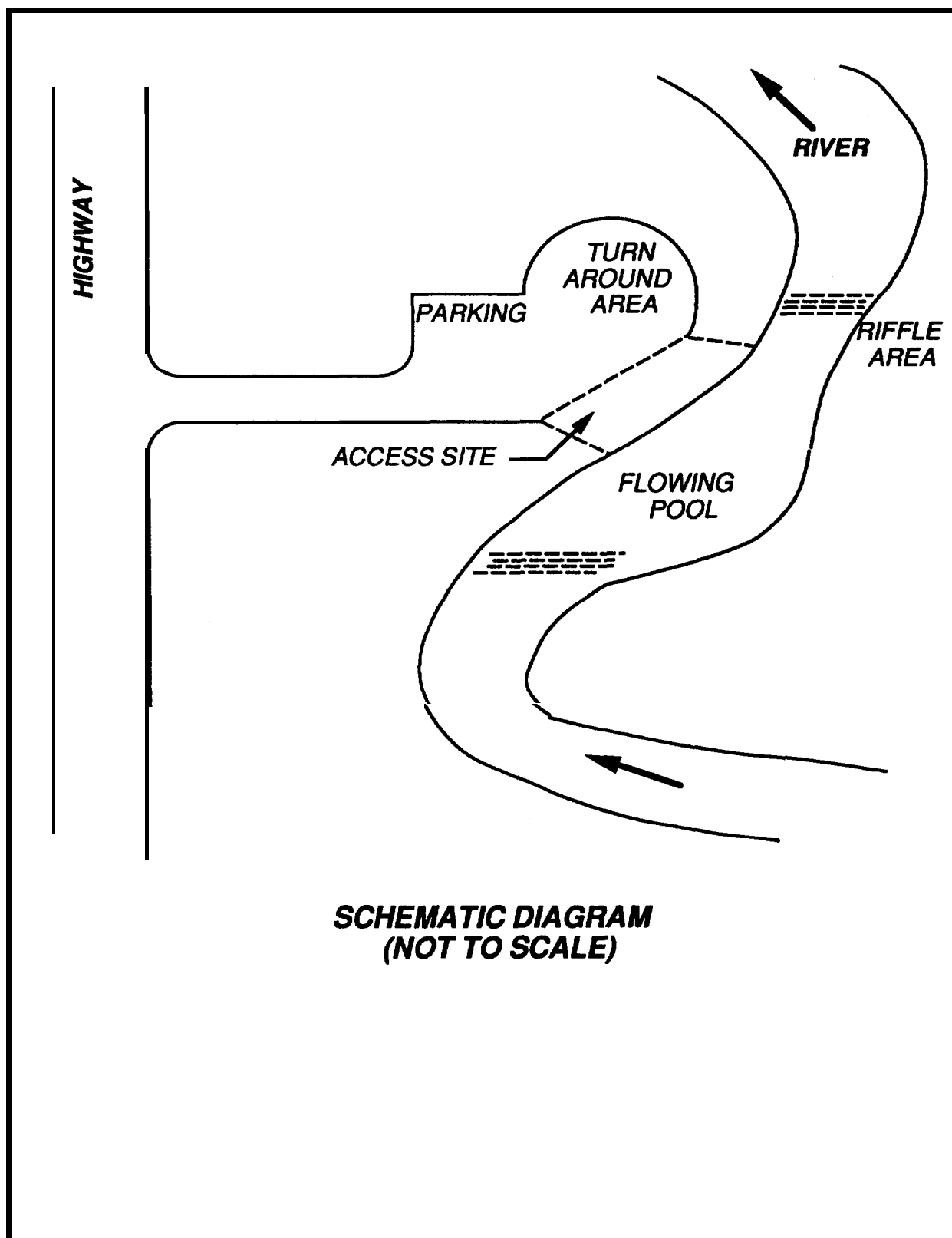
### **Schedule**

- **ChS**  
March-June (molts)  
April 15 - July 15 (**ChS** adults)
- **ChF**  
Fingerling release September-November (rainfall driven increased flows)  
September - December (**ChF** Adults)
- **stsu**  
October - May (**StSu** Adults)

### **Facilities Necessary or Desirable for Direct Release**

1. **Improved** access to river (safety consideration)
2. **Flowing "pool"** near access
- 3: Public **parking** if access is open (2-3 spaces)

A generic layout of a direct release facility is shown on Figure 7.



**DIRECT RELEASE FACILITY  
FIGURE 7**

## **EXTENDED REARING/ACCLIMATION FACILITIES**

### **Definition**

Extended rearing/acclimation consists of holding fish in ponds adjacent to the release site for a period of time ranging from 3 to 30 days prior to **release**.

### **Number of Fish**

#### **Spring Chinook**

In the near term (1992-1996) a maximum of 400,000 **ChS** will be released in the Umatilla **from** Croup 1 of the Umatilla NEOH program component of 589,000.

#### **Fall Chinook**

In the near term (1992-1996) a maximum of 5.94 million **ChF** will be released in the Umatilla, including 1.26 million direct release **from** hatchery, 3.24 million between river miles 56 to 73, and 1.44 million between river miles 34 to 56.

### **Unit Assumption**

Assume 1 unit equals 100,000 fish **@ 10/lb** (arbitrary but convenient)  
Have 4 units to provide new facilities

### **Schedule**

Spring acclimation: March - May 15

### **Flow Required**

Approximately 4 **cfs/unit** (0.018 **gpm/fish**)

### **Acclimation Unit Options to be Considered**

- Option 1 - Holding Raceway - Concrete Trough  
A minimum of 2 independent sub units (tanks) per unit  
Volume each unit 8,600 cf  
**Area per unit - 2 acres**
- Option 2 - Pond (Earthen or FML Lined)  
One or more ponds per unit  
Volume each unit 20,000 cf  
Area per unit (general) 4 acres
- Option 3 - Flow through Natural Pond  
Environment with developed cover and vegetation  
One pond per unit  
Volume each unit 20,000 (plus) cf  
Area per unit (general) 4 (plus) acres

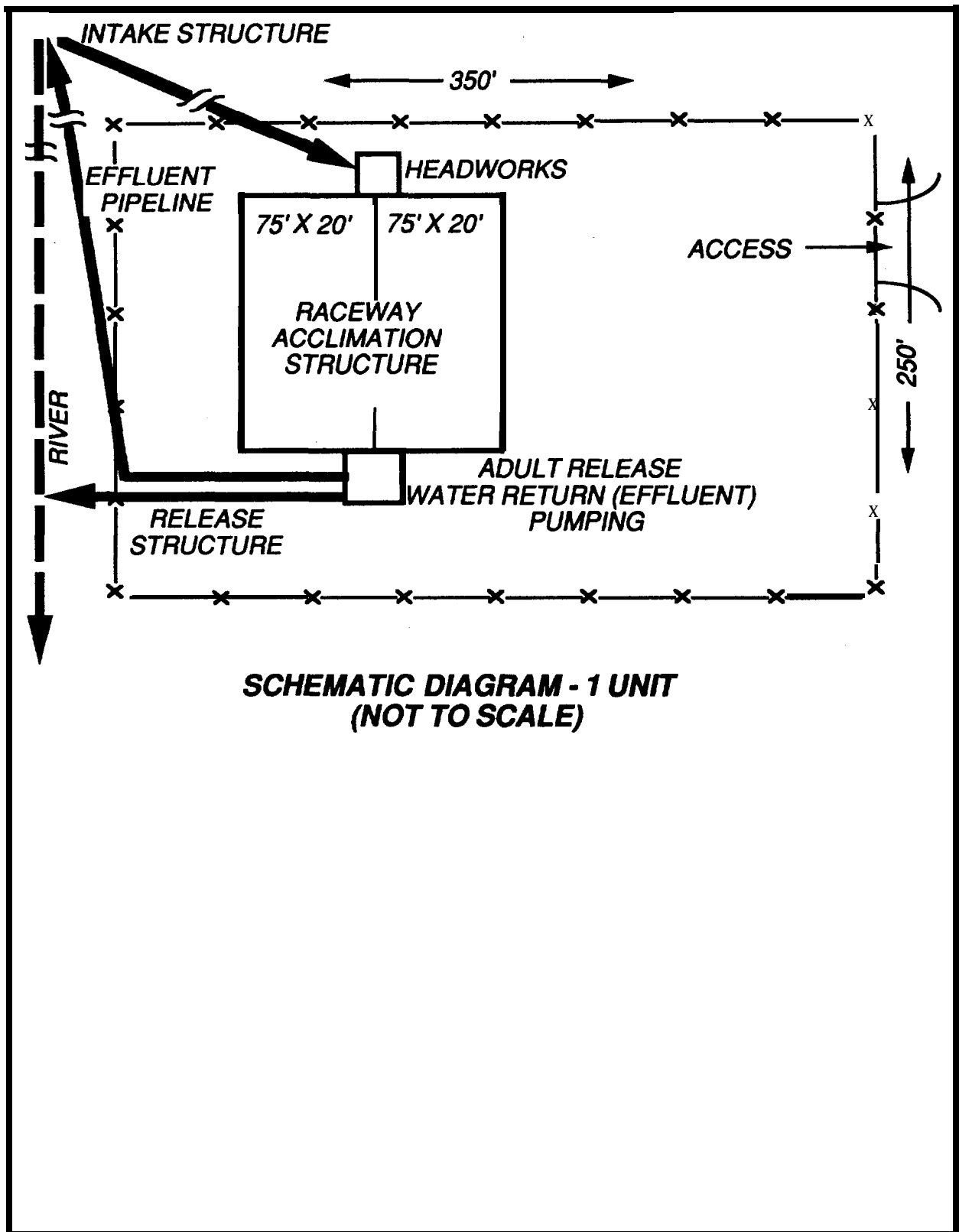


- Option 4 - Natural Side Channel  
One per unit  
Volume per unit - **10,000 ±** cf  
**Area** per unit - depending upon site selection

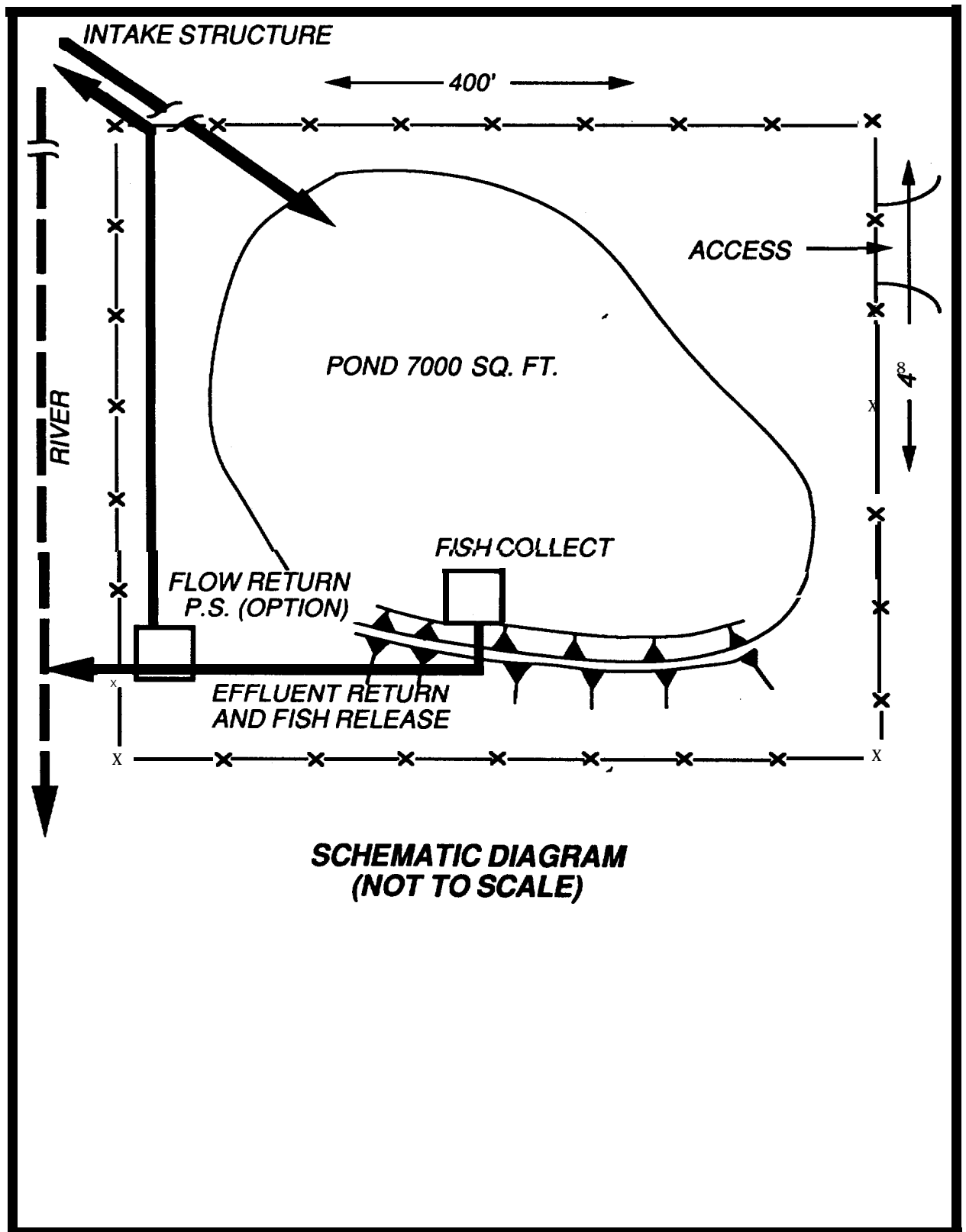
**Facilities Necessary or Desirable for an Acclimation Facility**

1. Water intake and supply
2. Raceway **tankage/pond**
3. Access
4. Security
5. Water discharge and **return** facilities
6. volitional **release structure**
7. Fish barrier/ screens

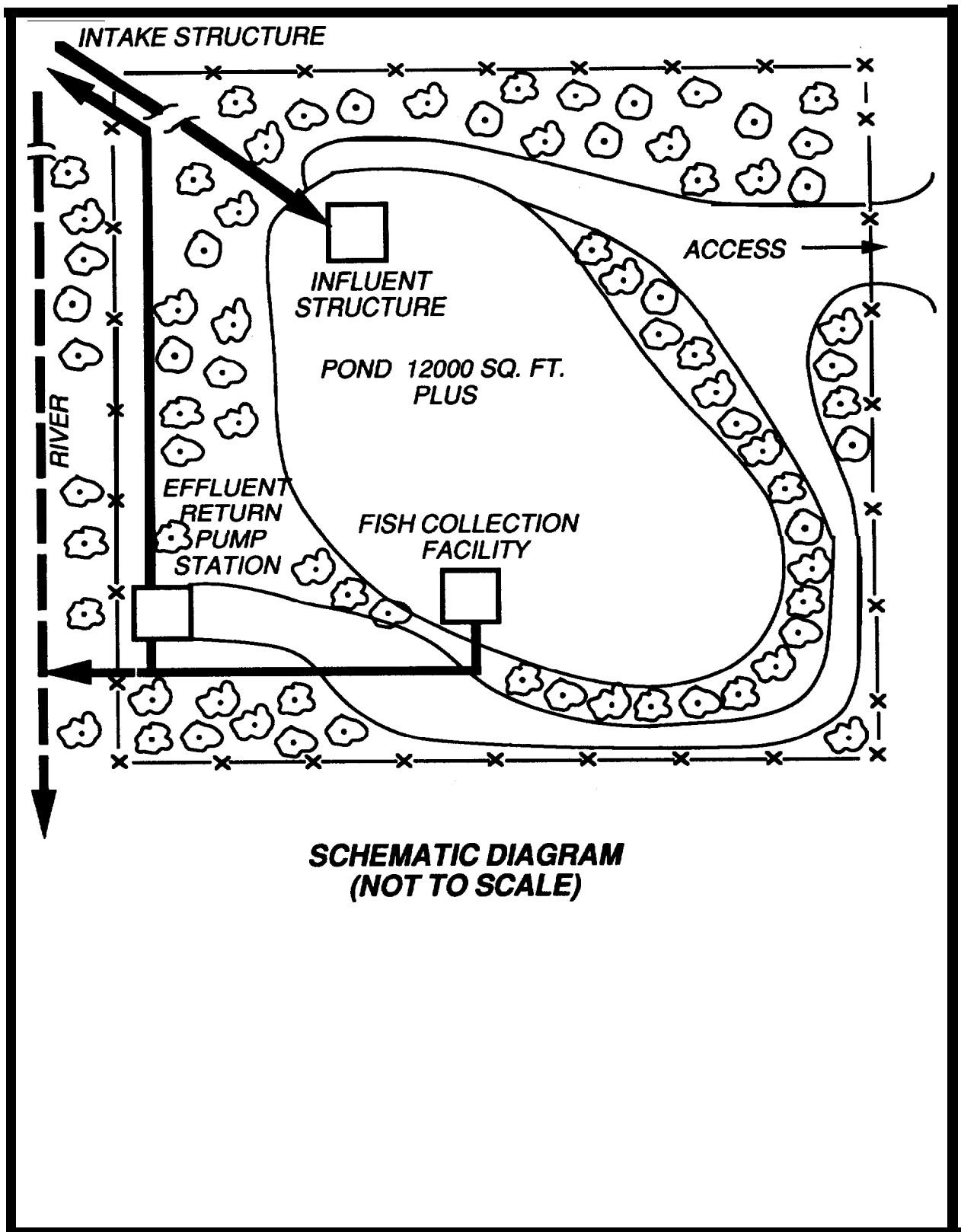
**Generic** layouts of the options for extended rearing/acclimation are shown on Figures 8 through 11.



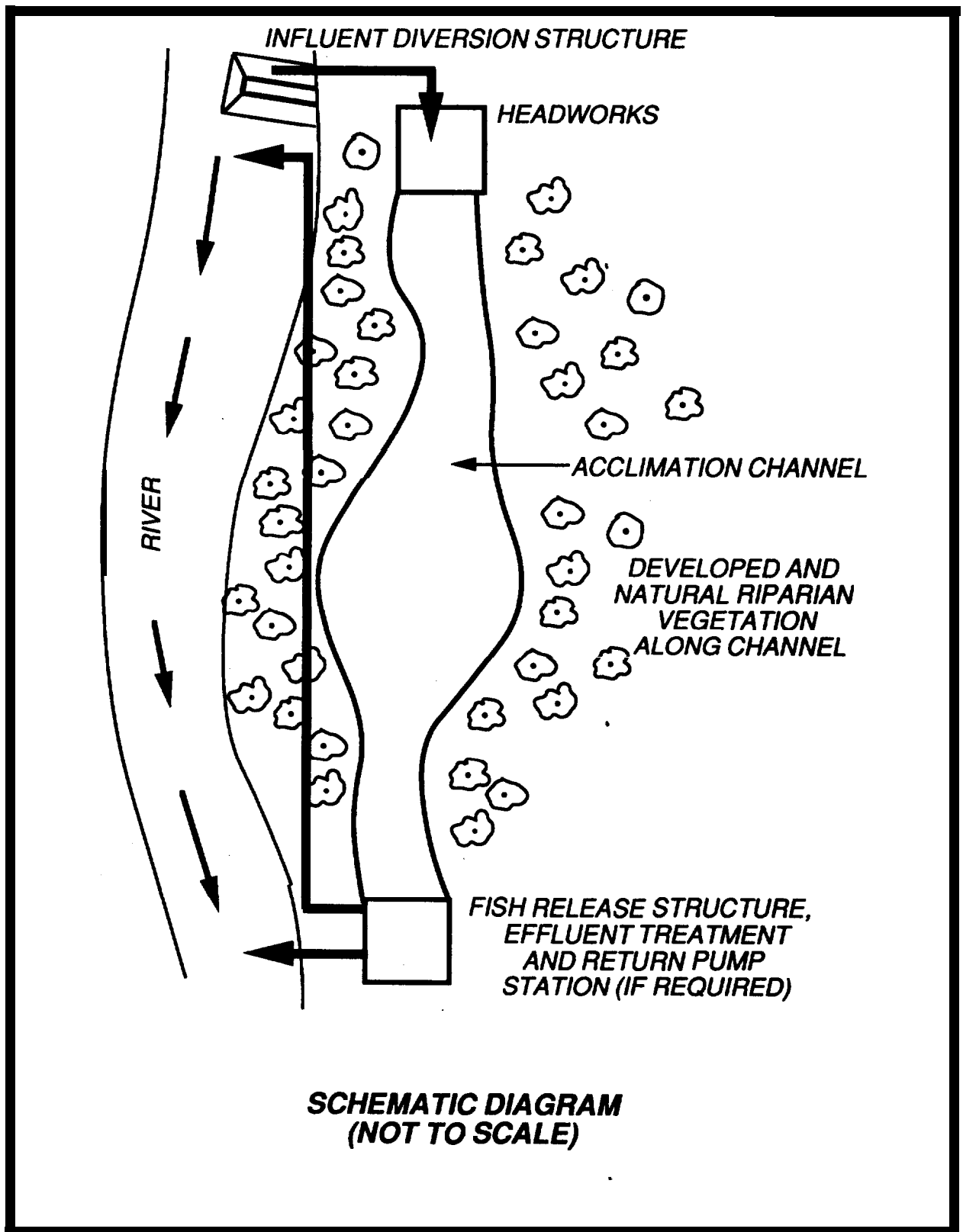
**ACCLIMATION FACILITIES OPTION 1  
HOLDING RACEWAY / CONCRETE TROUGH  
FIGURE 8**



**ACCLIMATION FACILITIES OPTION 2  
EARTHEN OR FML LINED POND  
FIGURE 9**



**ACCLIMATION FACILITIES OPTION 3  
FLOW THROUGH NATURAL POND  
FIGURE 10**



**ACCLIMATION FACILITIES OPTION 4  
NATURAL SIDE CHANNEL  
FIGURE 11**

## **MINI-HATCHERY**

### **House Lento Creek (Calif) System Type**

#### **Facility Size per Unit**

**50,000** smolts (**10/lb**) (preliminary assumption)

#### **Water Quantity**

River water **8 lb/gpm** = 700 gpm (1.6 cfs)

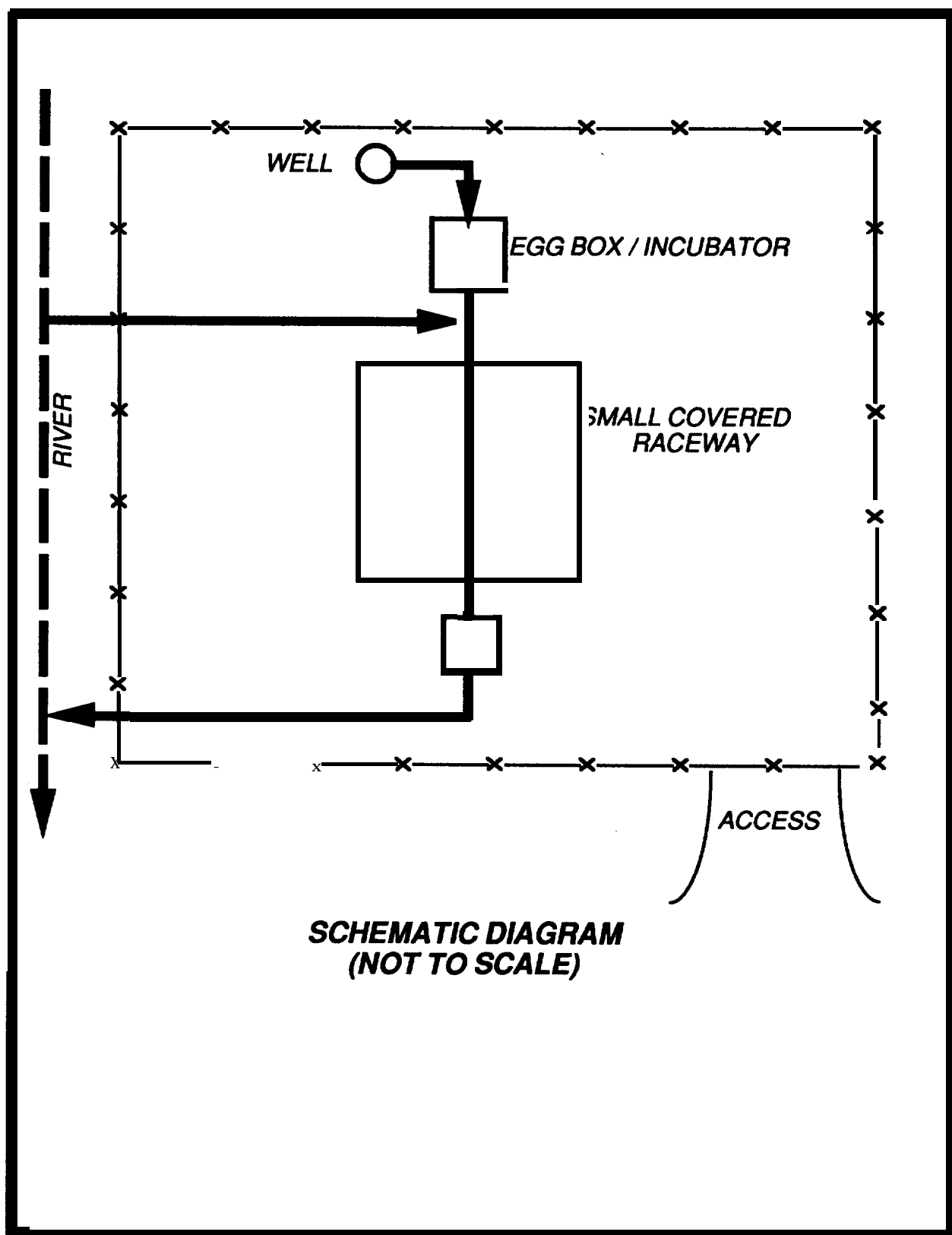
Groundwater **2.55 lb/gpm** 70 gpm

All incubation and early rearing (up to **500/lb**) must be on groundwater or a **disinfected** surface water supply (**50°±5**)

#### **Facilities Required**

1. Water source surface and **ground** (disinfected surface water)
2. **Egg** source
3. Egg incubation (boxes, trough, etc.)
4. Raceways (2)
5. Utilities
6. Security
7. Sanitary Facilities
8. Personnel facilities

A generic layout of a mini hatchery facility is shown on Figure 12.



**MINI-HATCHERY INCUBATION AND REARING  
FIGURE 12**

## RECYCLE WATER REUSE FACILITIES

1. Conventional flow through facilities and refrigeration to use available water.

Assumption:

5,000 gpm flow

would require a peak ( $\Delta T=10^{\circ}\text{F}$ ) chiller capacity of approximately 2000 tons which equates to 1400 KWH

2. Reuse and Refrigeration

**Assumption:**

**5,000 gpm**  
500 gpm  
50 gpm

No recycle  
**Influent** 90% recycle  
**Influent** 99% recycle

3. Moist incubation for reduced groundwater use and **refrigeration** cost.
4. Use of pure oxygen for satellite rearing to reduce water demand in combination with refrigeration.

Example:

20 cfs flow through water  
8 cfs with **O<sub>2</sub>** supplementation

5. Reuse for rearing supply.

Example:

90% reuse reduces flow from 20 to 2 cfs with increased costs and complexity but workable in a water shortage.

A generic layout of a recycle water reuse facility is shown on Figure 13.



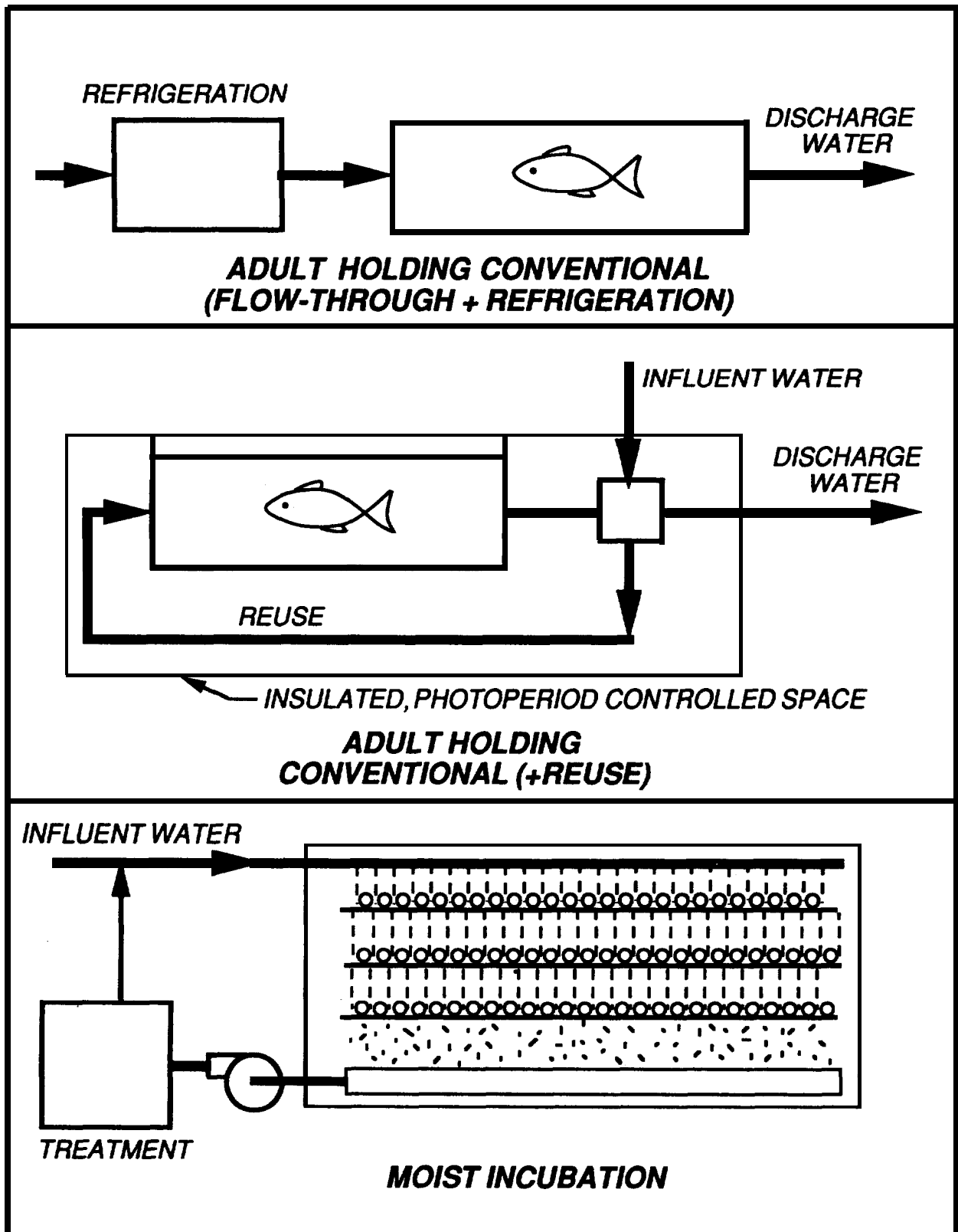


FIGURE 13

# SURFACE WATER AND GROUNDWATER AVAILABILITY AND QUALITY

## SURFACE WATER

### Availability

**Streamflow** data in the Umatilla River Basin was obtained from the U.S. Geological Survey and the U.S. Forest Service. The location of the gages with period of record greater than ten years is shown on Figure 14. The Umatilla River streamflow gages that were **summartized**, their source and period of record, include:

<u>Source</u>		<u>Identification</u>	<u>Record</u>
USGS	14020000	Umatilla River above Meacham <b>Creek</b>	<b>1933-1982</b>
USGS	14021000	Umatilla River at Pendleton	1934-1982
USGS	14022000	Umatilla River <b>above</b> McKay <b>Creek</b>	1923-1934
USGS	<b>14026000</b>	Umatilla River at <b>Yoakum</b>	1902-1982
USGS	14033500	Umatilla River near <b>Umatilla</b>	1903-1982
USFS	64114501	<b>Umatilla River near Corporation</b>	1967-1978
USFS	64114601	Umatilla River, North Fork near Corporation	1967-1978
USFS	64114701	Umatilla River, South Fork near Corporation	1967-1978

### Quality

Water temperature data was also provided by the Geological Survey and the Forest Service at the following sites:

<u>Source</u>		<u>Identification</u>	<u>Record</u>
USGS	14020000	Umatilla River <b>above</b> Meacham Creek	1933-1982
USGS	14033500	umatilla River nearumatilla	1903-1982
USFS	64114501	Umatilla River near <b>Corporation</b>	1967-1978
USFS	64114601	Umatilla River, North Fork near Corporation	1967-1978
USFS	64114701	Umatilla River, South Fork near Corporation	<b>1967-1978</b>

**In** addition, several months of water temperature data was obtained during a study of fish passage at Three Mile Dam near Umatilla. Concurrent flows were not reported as some flows were augmented for the study purposes.

The water quantity and quality data was summarized as average minimums, **maximums**, and means over the period of record stated. These statistics have been tabulated and graphed (Tables 14 through 17, Figures 15 through 32).

Other water quality parameters at several of the potential sites were collected during January 1991 and results are shown on Table 18.



**TABLE 14**  
**FOREST SERVICE STREAMFLOW DATA FOR**  
**NORTH AND SOUTH FORK UMATILLA AND CORPORATION**

STREAM GAGE AT CORPORATION, #641 1 4501			
	MIN	MEAN	MAX
OCT	19	42	111
NOV	21	67	689
DEC	23	175	1960
JAN	44	241	2973
FEB	65	212	1403
MAR	88	277	1174
APR	103	407	994
MAY	76	451	1172
JUN	38	165	1130
JUL	30	63	229
AUG	24	47	99
SEP	21	45	66

SOUTH FORK NEAR CORPORATION. #641 1 4701			
	MIN	MEAN	MAX
OCT	a	12	79
NOV	5	42	307
DEC	5	120	1642
JAN	14	116	1479
FEB	24	82	228
MAR	29	144	782
APR	74	200	1033
MAY	18	184	1014
JUN	6	48	477
JUL	5	14	111
AUG	3	9	25
SEP	3	9	58

NORTH FORK NEAR CORPORATION. #641 14601			
	MIN	MEAN	MAX
OCT	20	32	52
NOV	27	53	235
DEC	24	94	621
JAN	24	113	1236
FEB	41	93	483
MAR	46	109	514
APR	48	130	345
MAY	55	171	540
JUN	31	118	661
JUL	26	44	159
AUG	18	34	58
SEP	19	33	46

**TABLE 15****FOREST SERVICE WATER TEMPERATURE DATA FOR  
NORTH AND SOUTH FORK UMATILLA AND CORPORATION**

WATER TEMP. GAGE AT CORPORATION					
	Mean	Max	Mean	Min	Mean
					Mean
OCT		53		43	47
NOV		47		<b>39</b>	44
DEC		43		37	41
JAN		42		36	<b>39</b>
FEB		43		37	40
MAR		44		37	41
APR		47		<b>39</b>	42
MAY		52		40	44
JUN		61		44	51
JUL		65		<b>49</b>	57
AUG		64		51	57
SEP		58		48	52
WATER TEMP GAGE ON SOUTH FORK NEAR CORPORATION					
	Mean	Max	Mean	Min	Mean
					Mean
OCT		54		42	48
NOV		47		38	42
DEC		42		36	<b>39</b>
JAN		40		34	37
FEB		41		35	38
MAR		44		36	<b>39</b>
APR		46		37	40
MAY		54		<b>39</b>	45
JUN		63		44	53
JUL		67		52	<b>59</b>
AUG		67		55	60
SEP		64		<b>49</b>	56
WATER TEMP. GAGE ON NORTH FORK NEAR CORPORATION					
	Mean	Max	Mean	Min	Mean
					Mean
OCT		51		43	46
NOV		47		<b>39</b>	44
DEC		44		37	41
JAN		42		36	40
FEB		43		37	40
MAR		44		38	41
APR		47		<b>39</b>	42
MAY		50		40	44
JUN		57		43	<b>49</b>
JUL		61		48	54
AUG		60		48	53
SEP		58		46	50

**TABLE 16**  
**GEOLOGICAL SURVEY STREAMFLOW DATA**

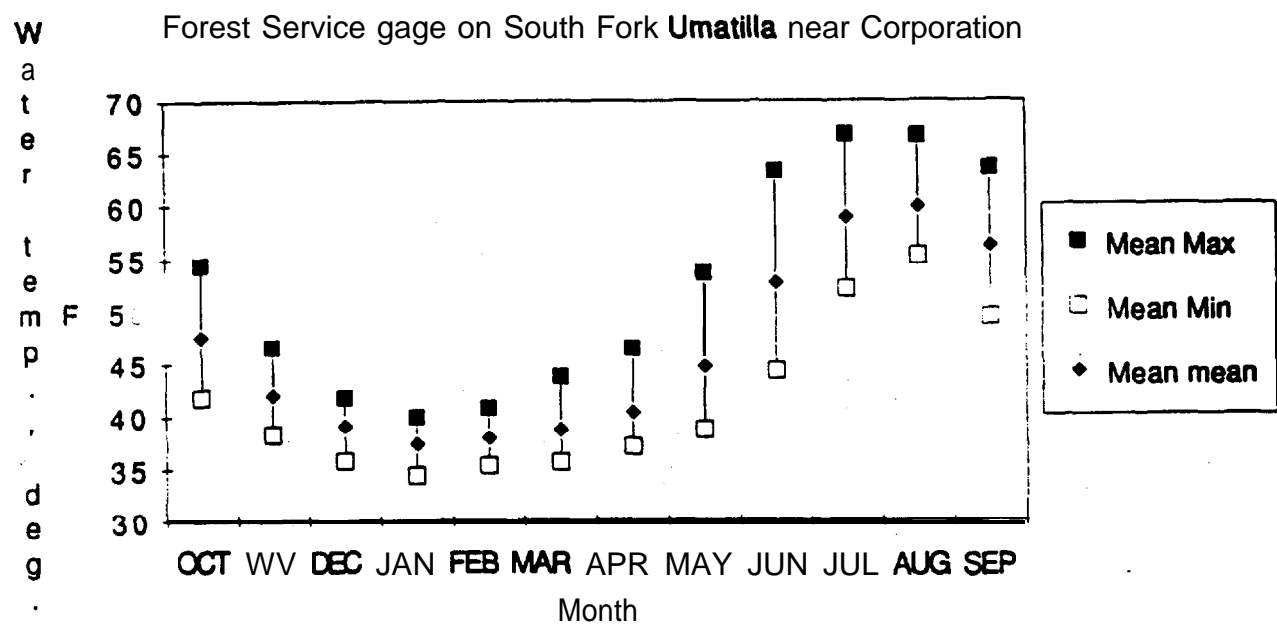
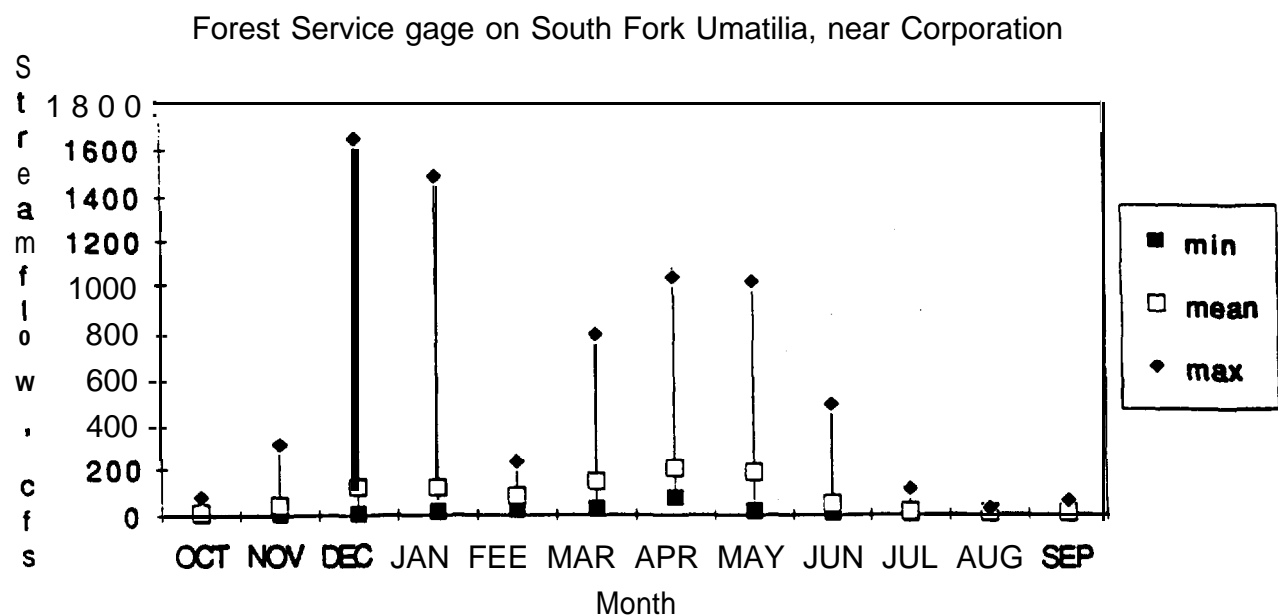
Umatilla River at Meacham 14020000				Umatilla River at Pendleton 14021000				Umatilla River at Yoakum alter construction of McKay Reservoir 14026000			
	MN	MEAN	MAX		MN	MEAN	MAX		MN	MEAN	MAX
OCT	39	59	169	c c l	37	74	246	OCT	44	97	455
NOV	40	125	405	NOV	52	227	a45	NOV	59	265	153s
DEC	44	250	716	DEC	69	561	1786	DEC	76	620	2054
JAN	46	267	656	JAN	70	650	2068	JAN	82	755	2204
FEB	72	316	910	FEB	107	a43	2375	FEB	115	956	3057
MAR	199	370	989	MAR	410	1003	2672	MAR	413	1249	3654
APR	162	540	885	A m	299	1321	2347	APR	358	1661	3334
MAY	67	450	1135	MAY	198	876	2519	MAY	256	1072	3445
JUN	64	197	591	JUN	64	319	692	JUN	244	485	1220
JUL	40	66	110	JUL	15	76	189	JUL	211	352	456
AUG	37	48	63	AUG	17	38	76	AUG	123	304	416
SEP	35	40	82	SEP	23	45	85	SEP	22	163	305
Meacham Creek at Gibbon 14020300				Umatilla River above McKay Creek 14022000				Umatilla River e t Umatilla 14033500			
	MN	MEAN	MAX		MN	MEAN	MAX		MIN	MEAN	MAX
OCT	11	17	35	OCT	47	100	451	OCT	4.2	77	331
NOV	23	51	144	NOV	57	293	1466	N W	40	226	878
DEC	60	204	671	DEC	7s	413	686	DEC	79	551	1948
JAN	66	215	762	JAN	85	564	1532	JAN	89	669	2366
FEB	99	365	1223	FEE	164	767	1494	FEB	87	898	2994
MAR	202	430	922	MAR	510	1125	2470	MAR	154	1029	3679
APR	252	526	1124	APR	452	1199	2022	APR	46	1134	3056
MAY	126	291	597	MAY	104	660	1680	MAY	16	560	3362
JUN	41	107	271	JUN	50	223	631	JUN	13	111	805
JUL	13	24	46	JUL	23	44	77	JUL	13	21	149
AUG	9	12	17	AUG	14	24	32	AUG	13	23	66
SEP	9	12	17	SEP	27	46	129	SEP	1.3	35	124
				Umatilla River at Yoakum before construction of McKay Reservoir 14026000							
					MN	MEAN	MAX				
				OCT	40	91	224				
				NOV	58	263	827				
				DEC	107	580	1362				
				JAN	123	772	2761				
				FEB	273	1154	2879				
				MAR	450	1640	3581				
				APR	843	2177	4636				
				MAY	230	1266	4766				
				JUN	48	411	1622				
				JUL	20	85	255				
				A m	19	40	109				
				SEP	30	49	92				

**TABLE 17**  
**GEOLOGICAL SURVEY WATER TEMPERATURE DATA**

Umatilla River at Meacham Creek 14020000			
Years 1959-1980 Water Temperatures, in deg. F			
	<u>MIN</u>	<u>MAX</u>	
<b>OCT</b>	<b>37.9</b>	59.0	
<b>NOV</b>	34.7	51.8	
<b>DEC</b>	32.0	46.9	
<b>JAN</b>	32.0	45.0	
<b>FEB</b>	32.0	45.0	
<b>MAR</b>	33.1	50.0	
<b>APR</b>	37.0	57.2	
<b>MAY</b>	37.9	66.0	
<b>JUN</b>	42.1	73.9	
<b>JUL</b>	46.9	77.0	
<b>AUG</b>	48.9	75.0	
<b>SEP</b>	44.6	70.7	

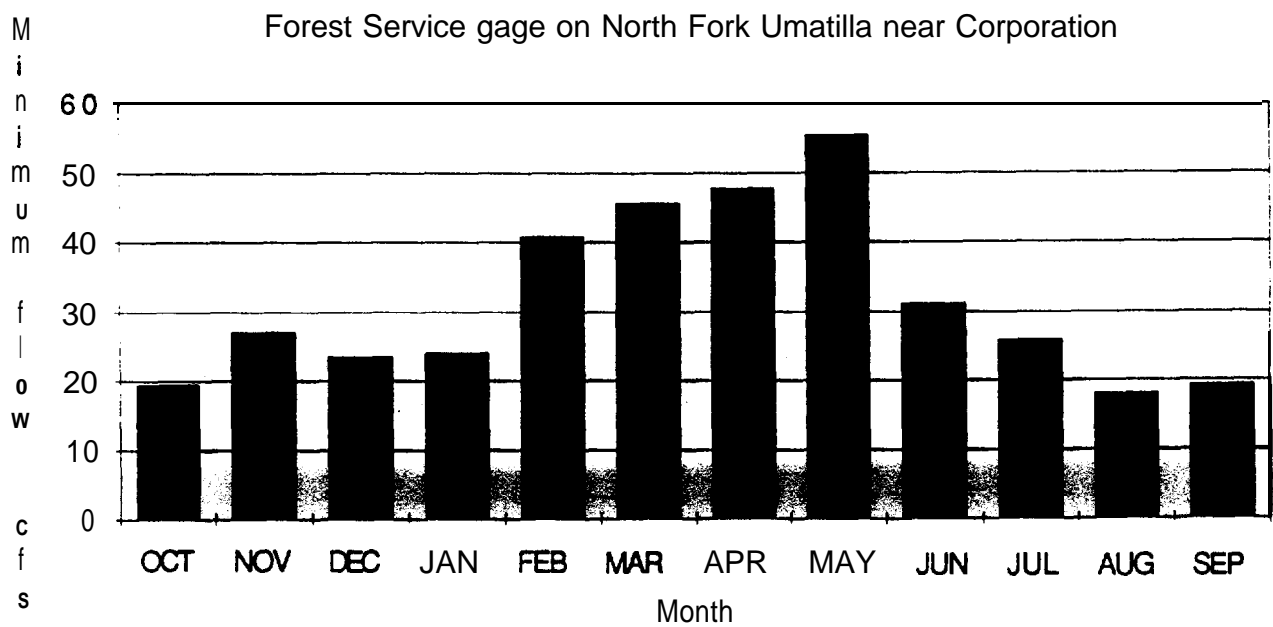
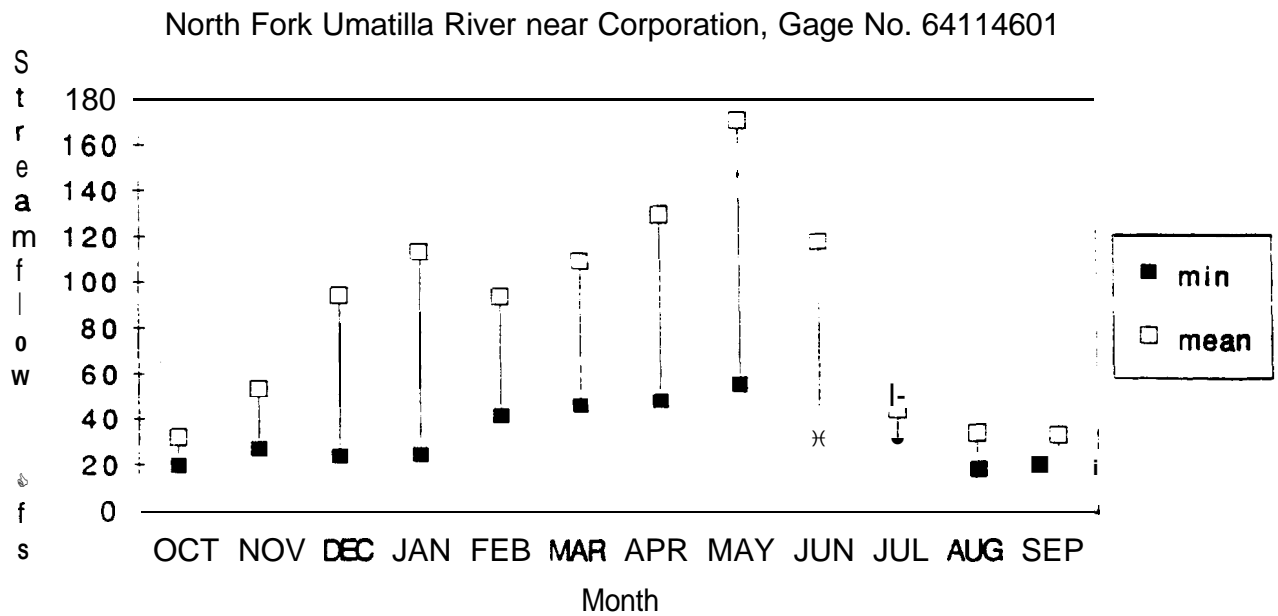
Umatilla River near Umatilla 14033500			
Years 1963-69 Water Temperatures, in deg. F			
	<u>MIN</u>	<u>MAX</u>	<u>MEAN</u>
<b>OCT</b>	45.0	68.0	57.2
<b>NOV</b>	39.2	59.0	48.4
<b>DEC</b>	32.0	54.0	43.5
<b>JAN</b>	32.0	51.8	40.8
<b>FEB</b>	32.9	56.3	45.0
<b>MAR</b>	40.1	62.1	50.7
<b>APR</b>	48.0	69.8	54.0
<b>MAY</b>	45.9	80.1	58.8
<b>JUN</b>	51.1	81.0	66.6
<b>JUL</b>	59.0	83.3	70.9
<b>AUG</b>	61.9	84.9	70.2
<b>SEP</b>	56.8	73.9	64.4



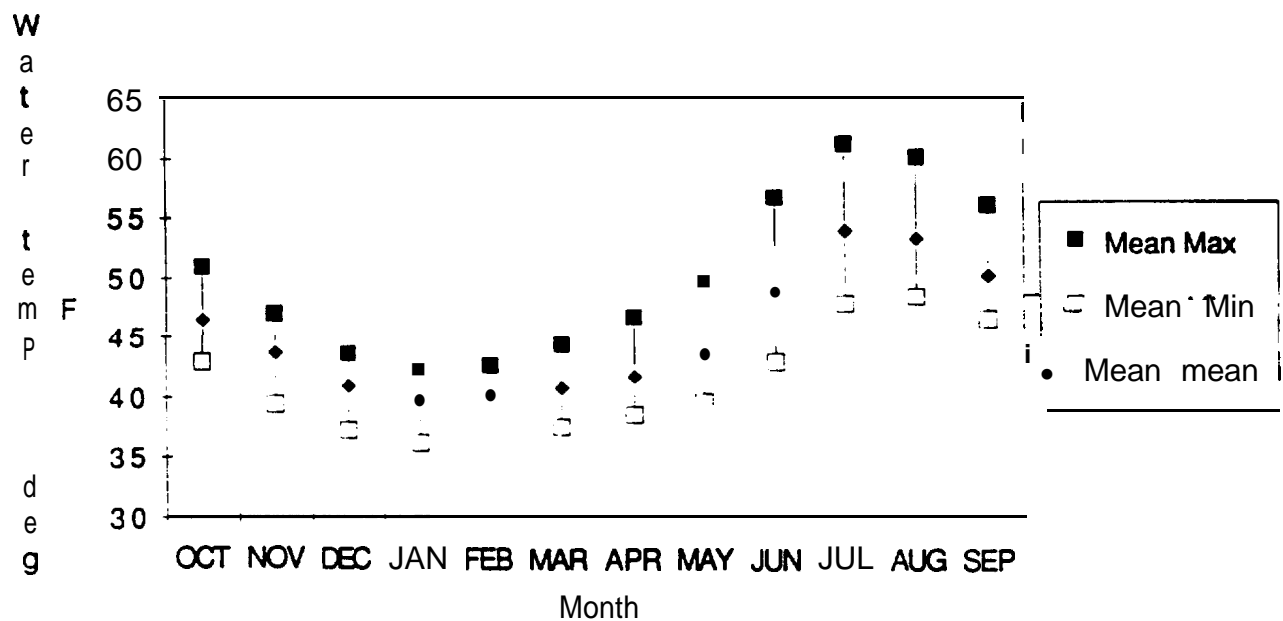
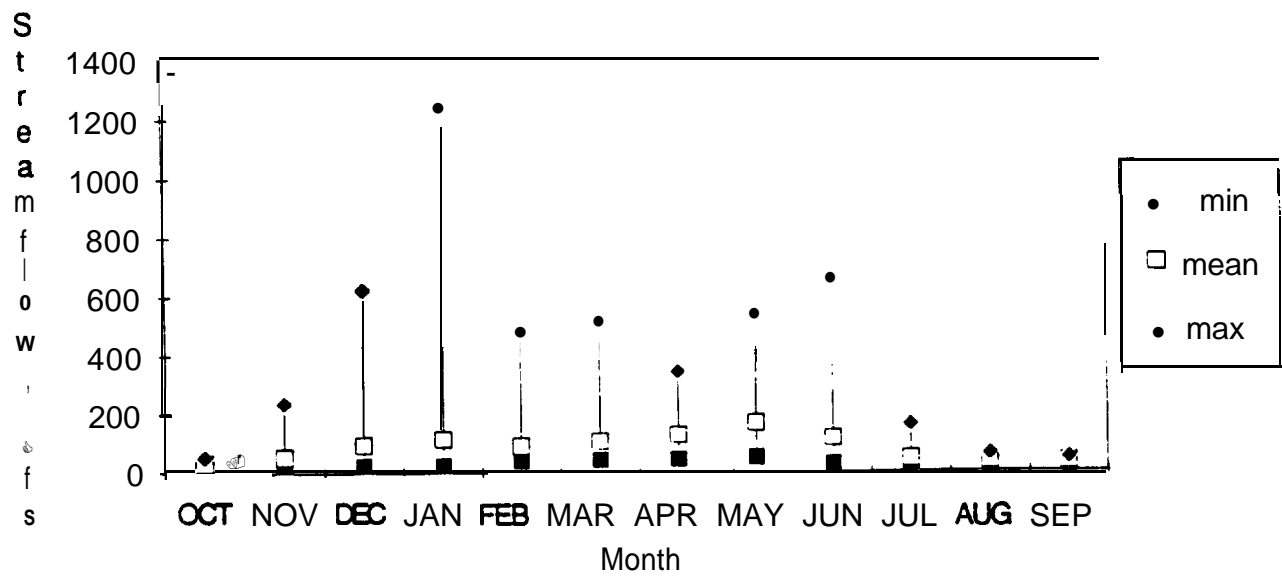
**FIGURE 15**

**USFS GAGE ON NORTH FORK UMATILLA RIVER (64114601)**  
**MINIMUM, MEAN, AND MAXIMUM STREAMFLOW AND TEMPERATURE**





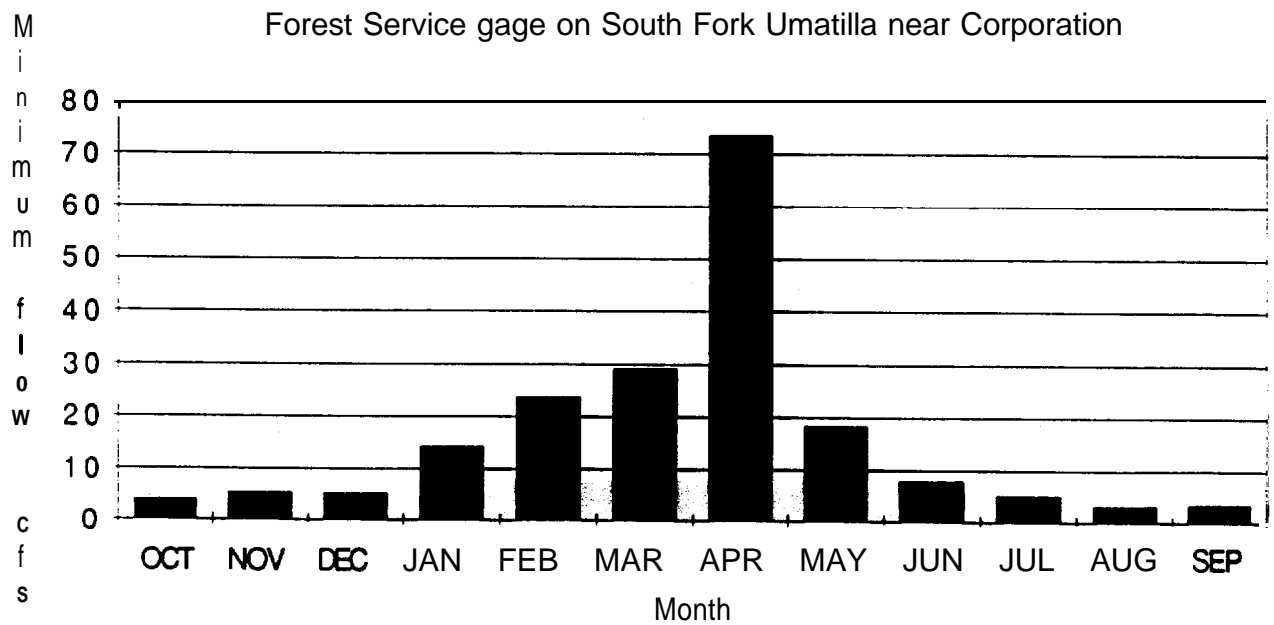
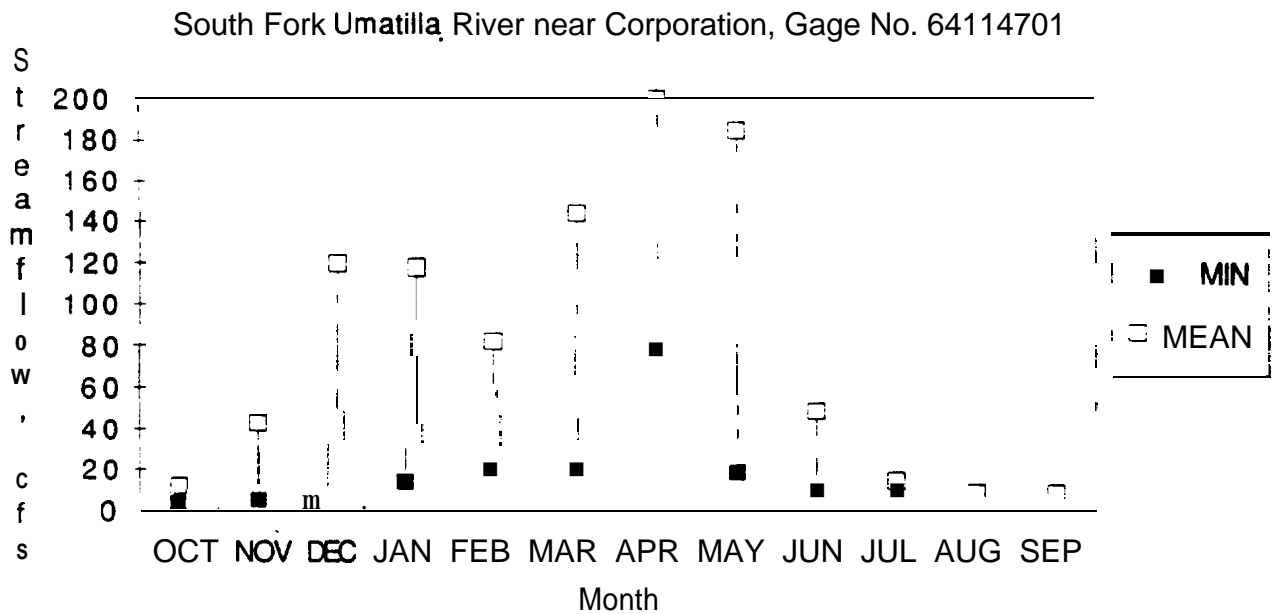
**FIGURE 16**  
**USFS GAGE ON NORTH FORK UMATILLA RIVER (64114601)**  
**MINIMUM STREAMFLOW**



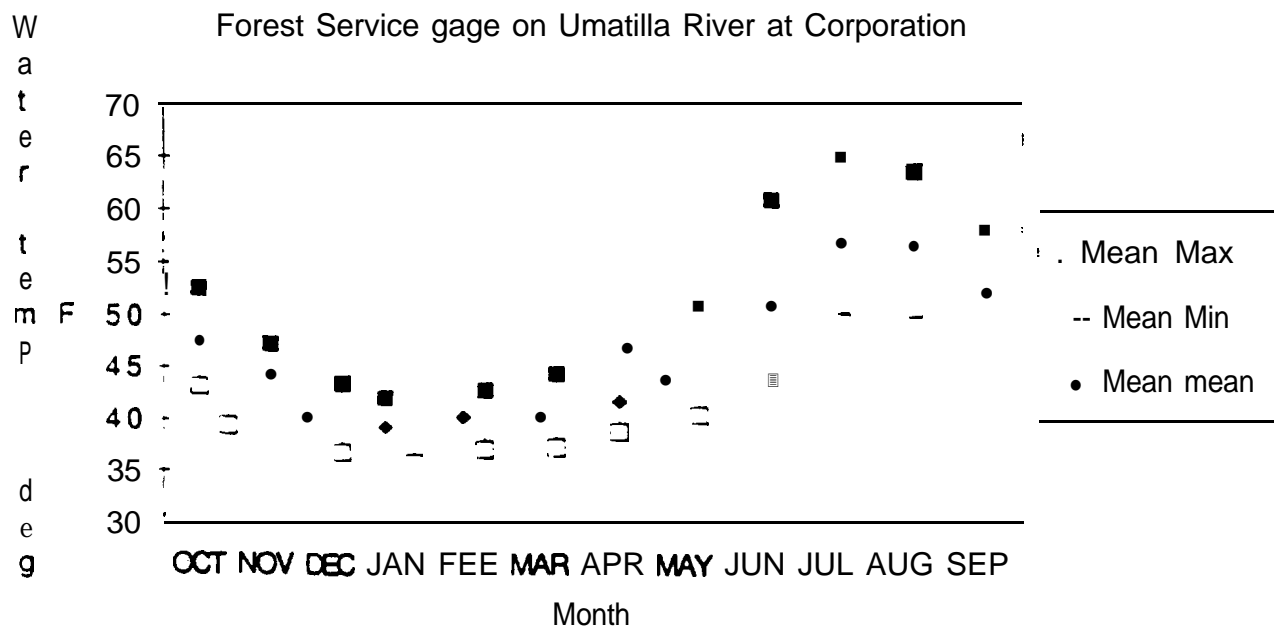
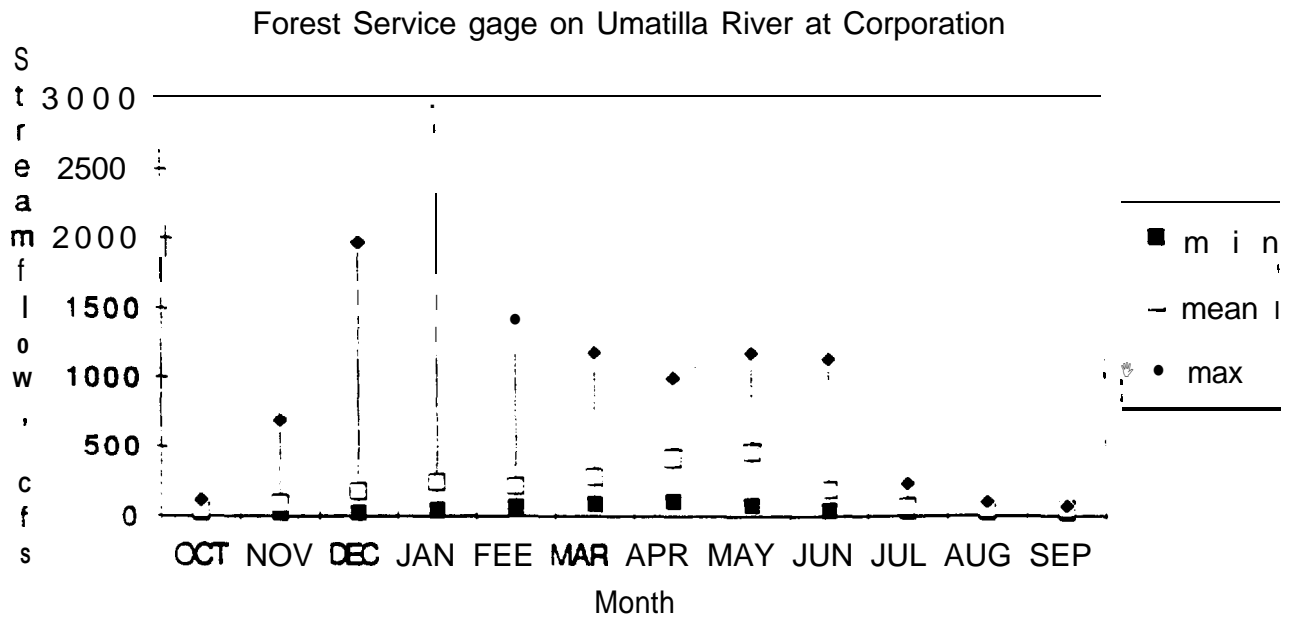
**FIGURE 17**

**USFS GAGE ON SOUTH FORK UMATILLA RIVER (64114701)**

**MINIMUM, MEAN, AND MAXIMUM STREAMFLOW AND TEMPERATURE**



**FIGURE 18**  
**USFS GAGE ON SOUTH FORK UMATILLA RIVER (64114701)**  
**MINIMUM STREAMFLOW**



**FIGURE 19**  
**FS GAGE AT CORPORATION (64114501)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**

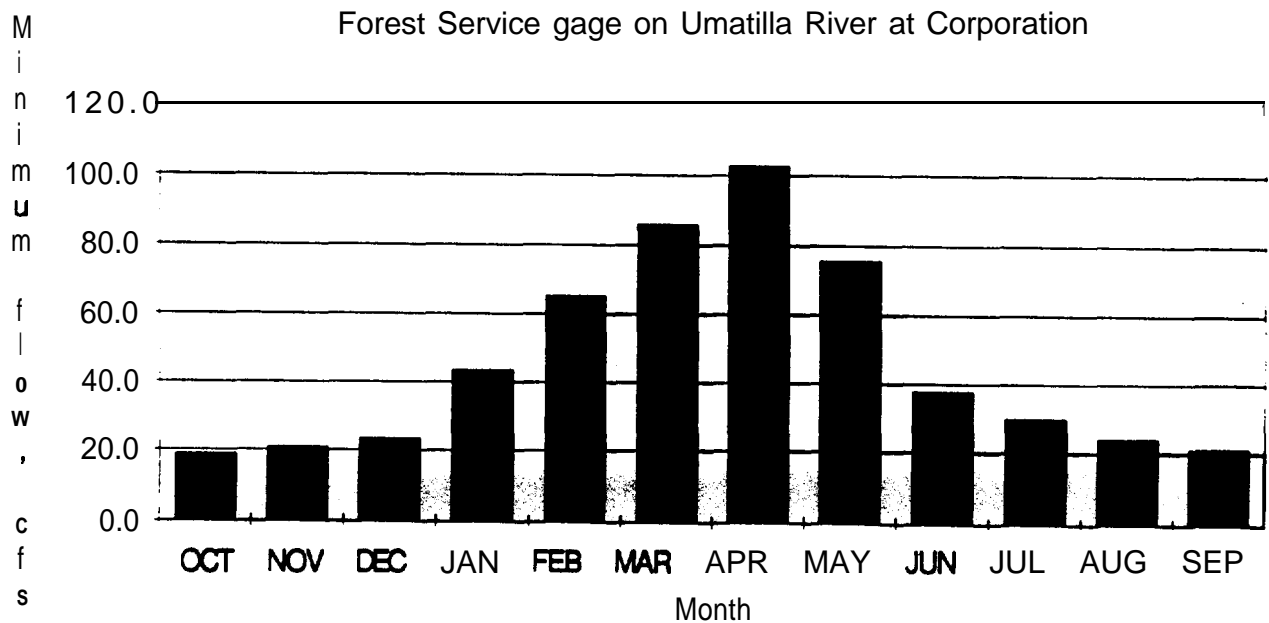
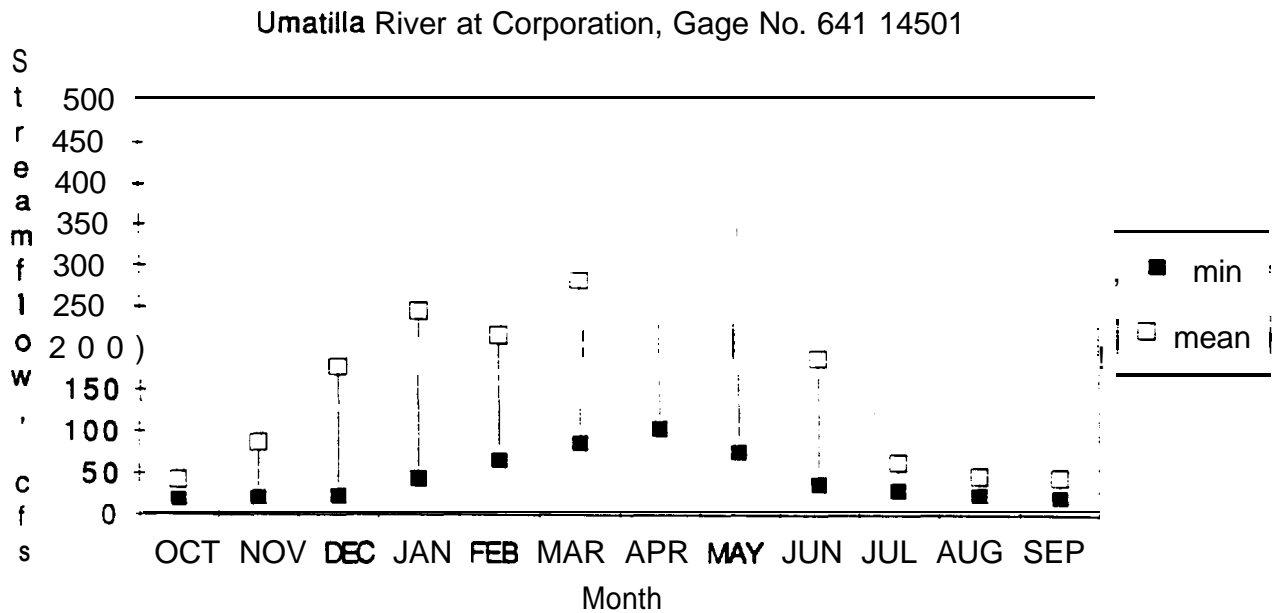
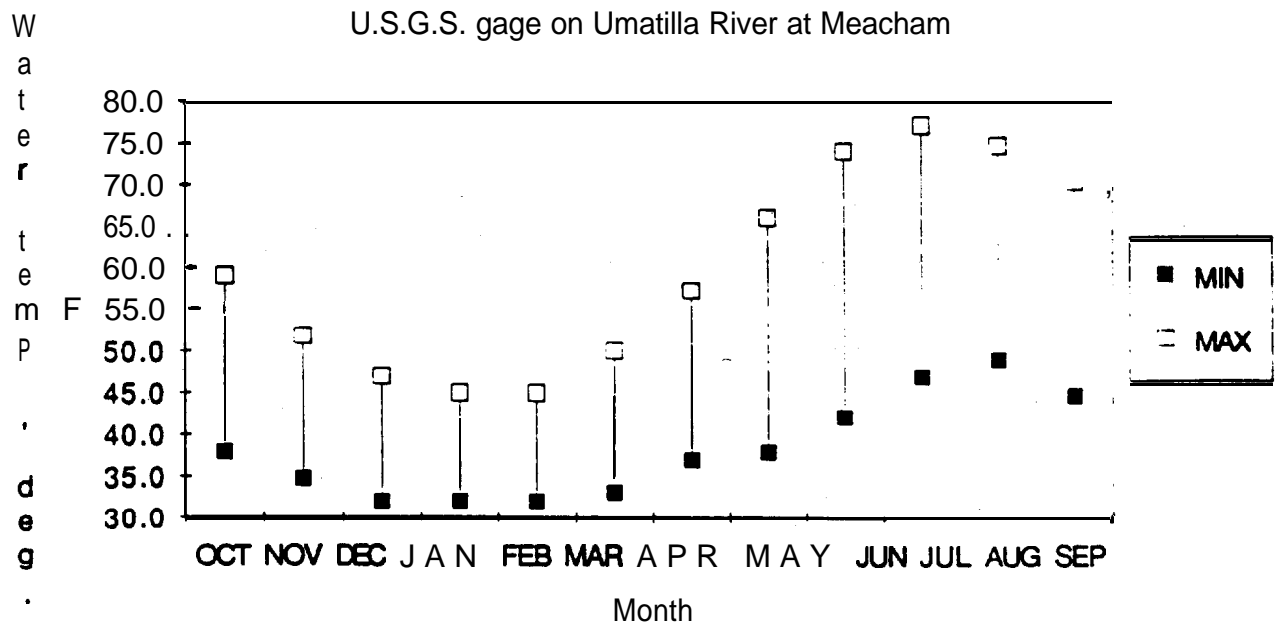
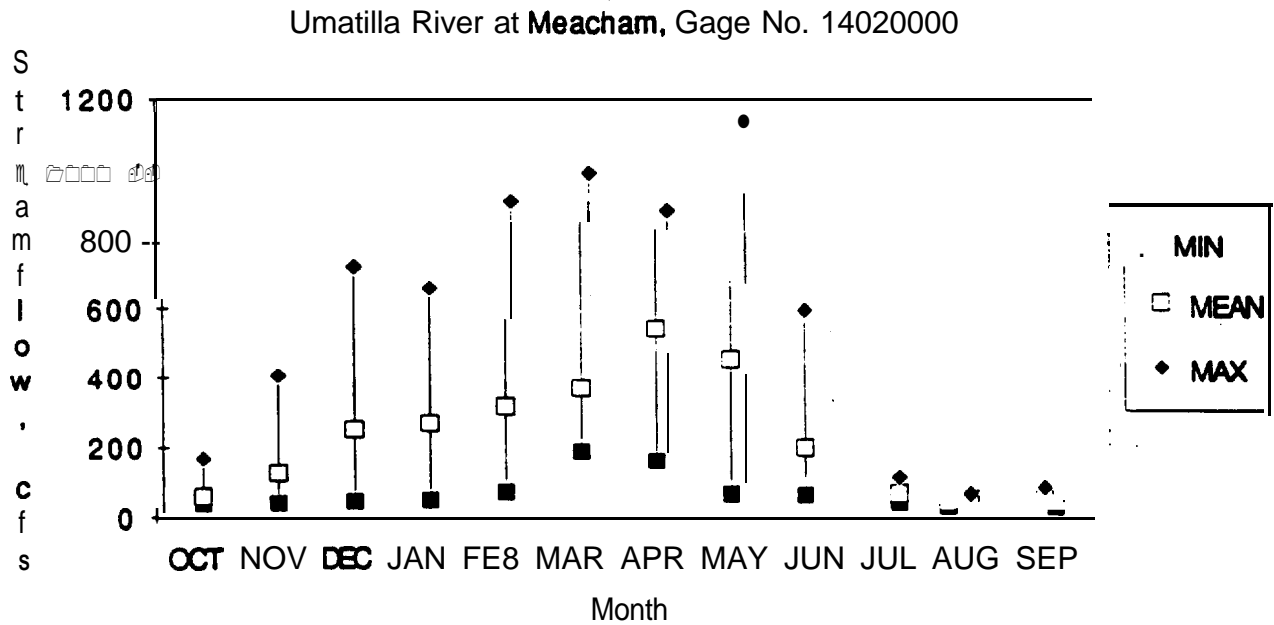
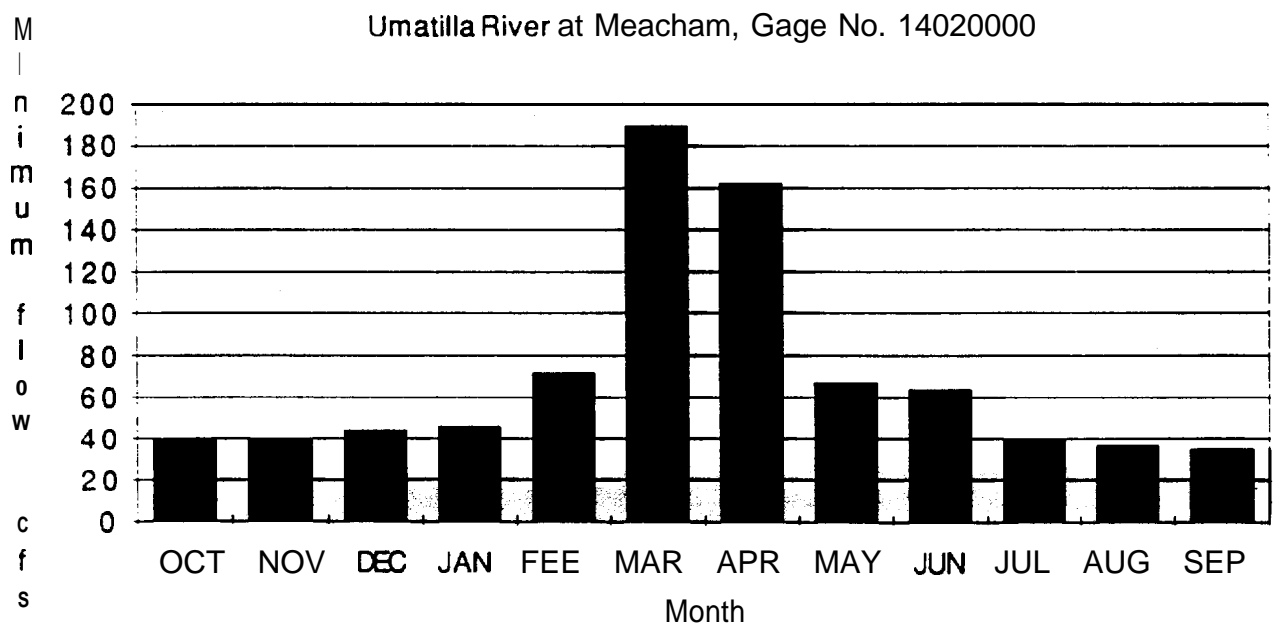


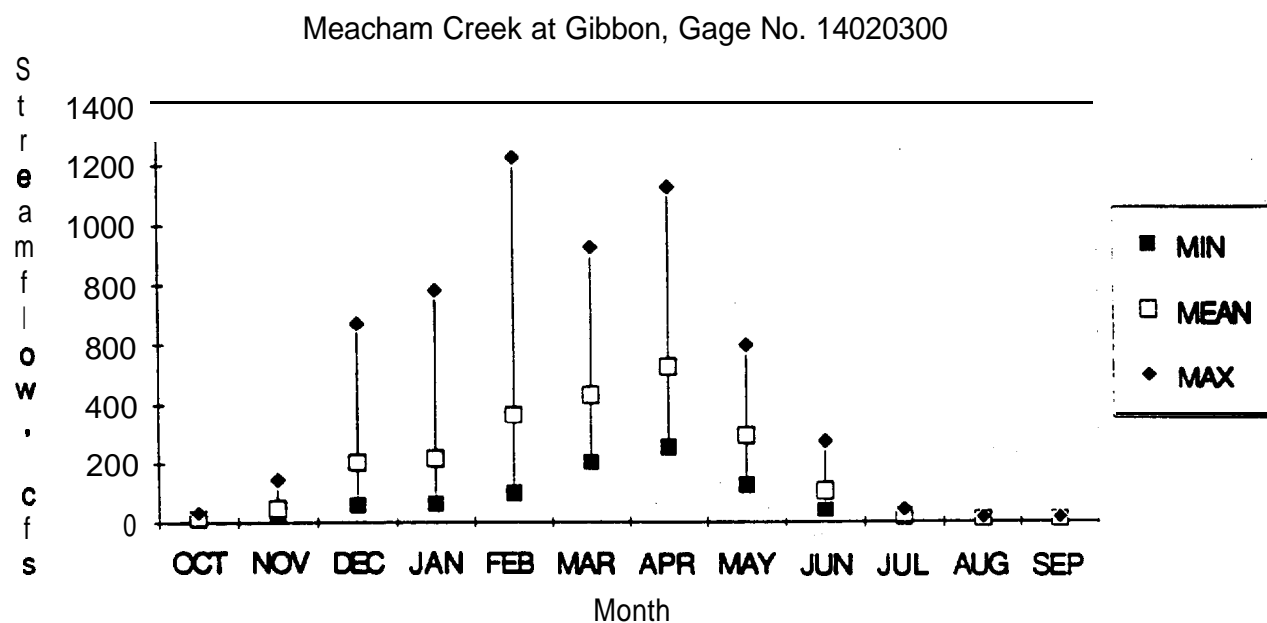
FIGURE 20  
USFS GAGE AT CORPORATION (64114501)  
MINIMUM STREAMFLOW



**FIGURE 21**  
**USGS GAGE ON UMATILLA RIVER ABOVE MEACHAM CREEK (14020000)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**



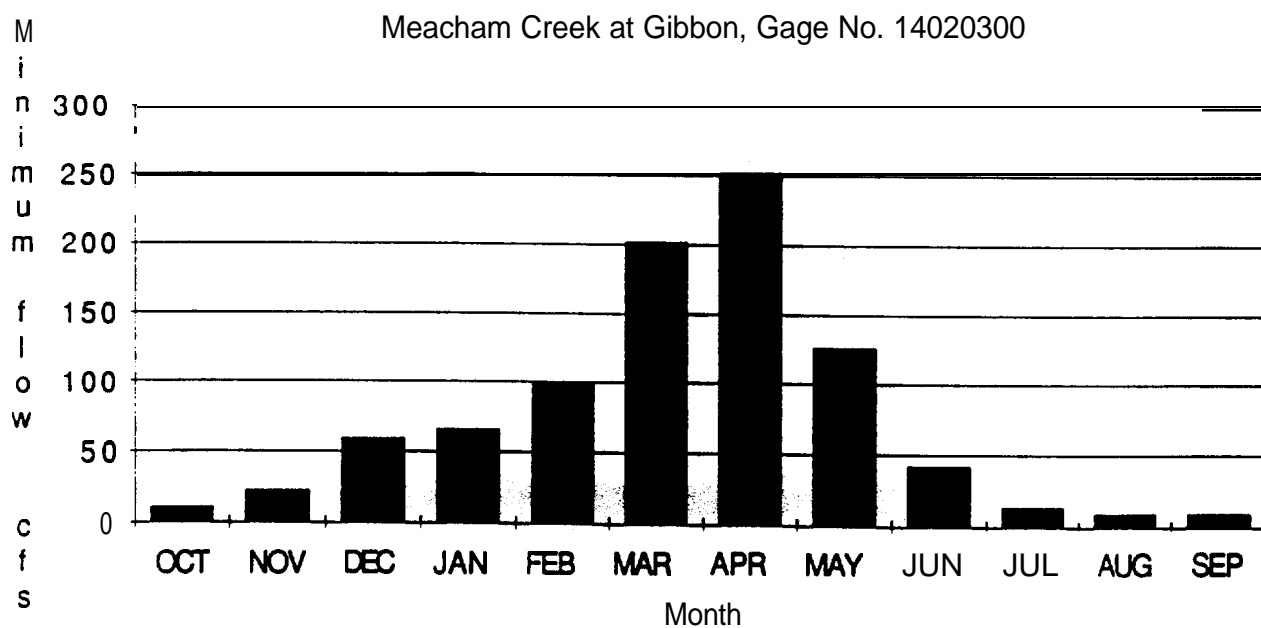
**FIGURE 22**  
**USGS GAGE ON UMATILLA RIVER ABOVE MEACHAM CREEK (14020000)**  
**MINIMUM STREAMFLOW**



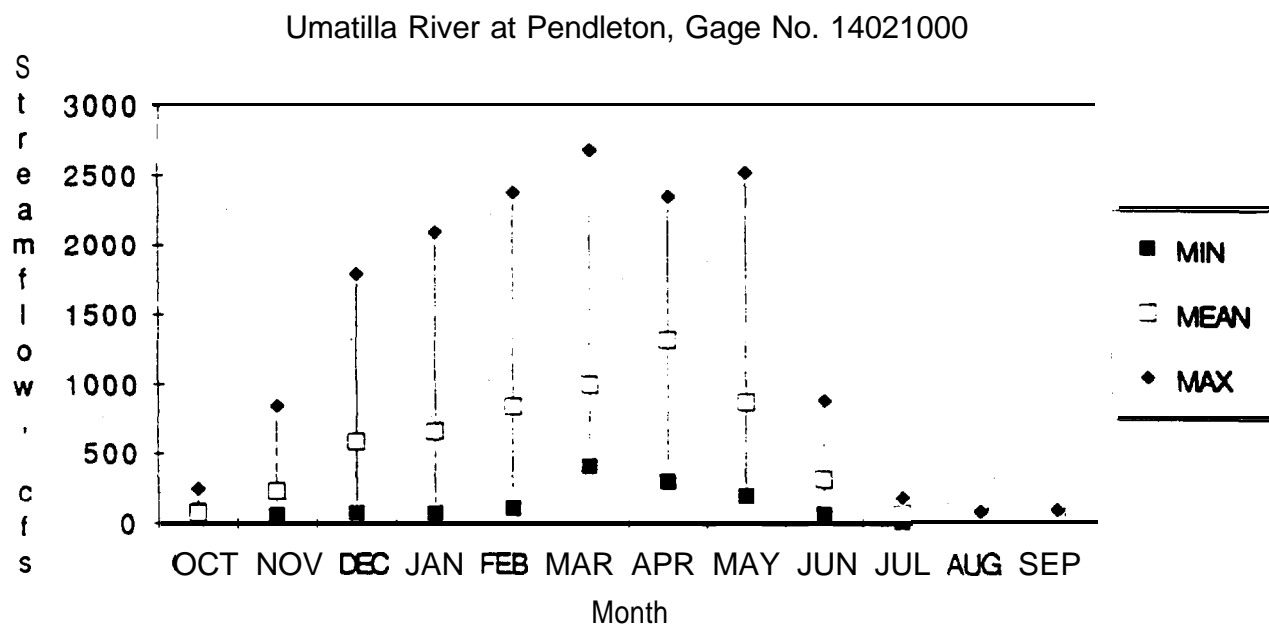
**FIGURE 23**

**USGS GAGE ON MEACHAM CREEK AT GIBBON (14020300)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**





**FIGURE 24**  
**USGS GAGE ON MEACHAM CREEK AT GIBBON (14020300)**  
**MINIMUM STREAMFLOW**



**FIGURE 25**  
**USGS GAGE ON UMATILLA RIVER AT PENDLETON (14021000)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**

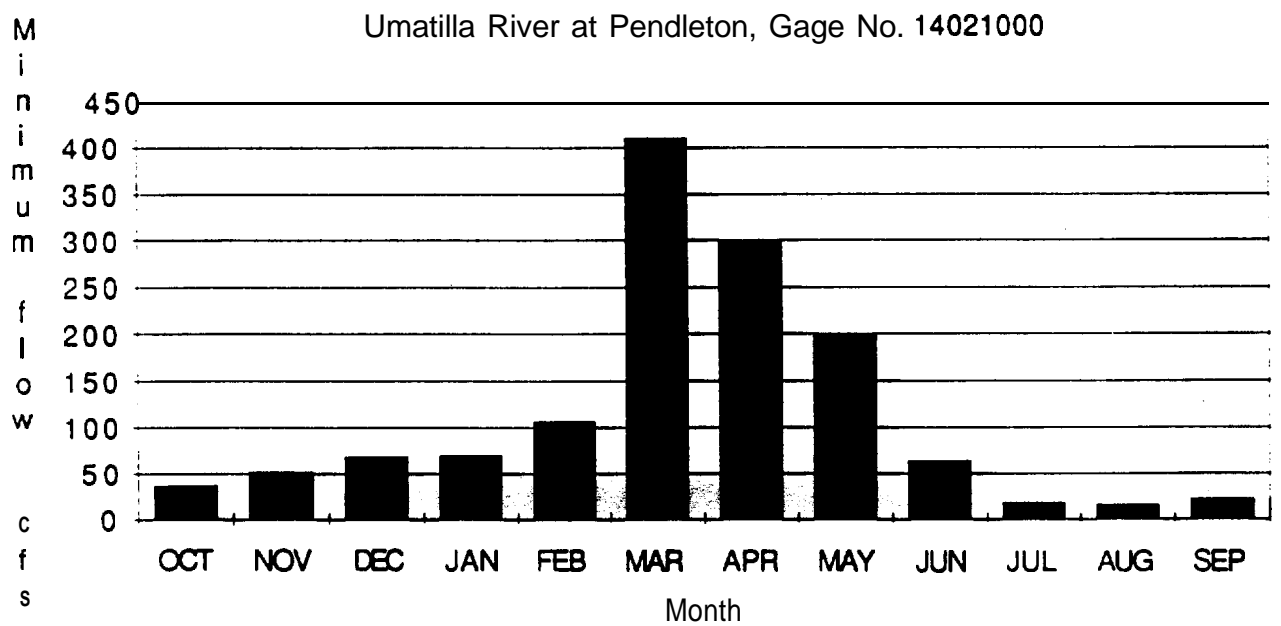
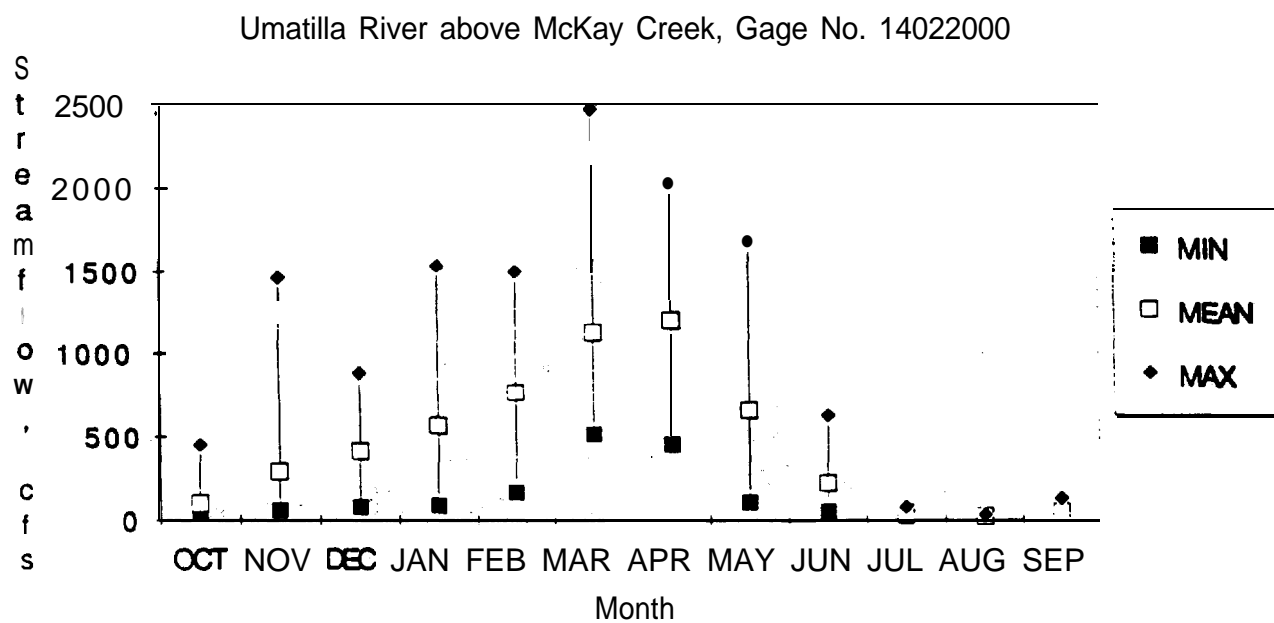
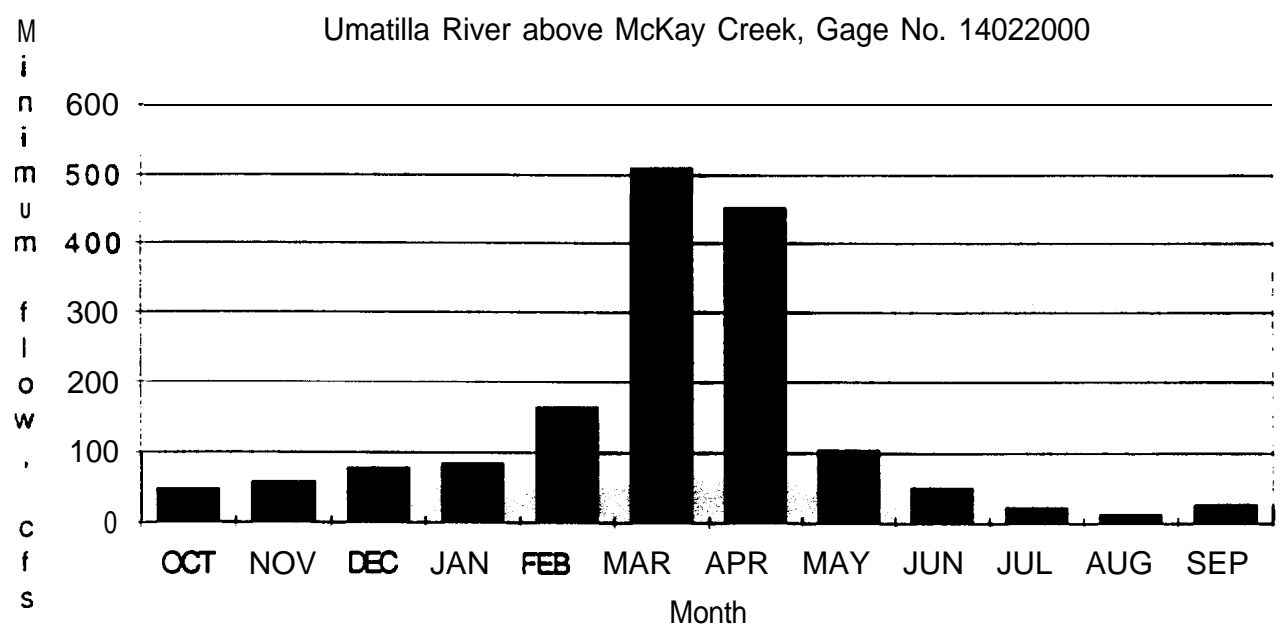


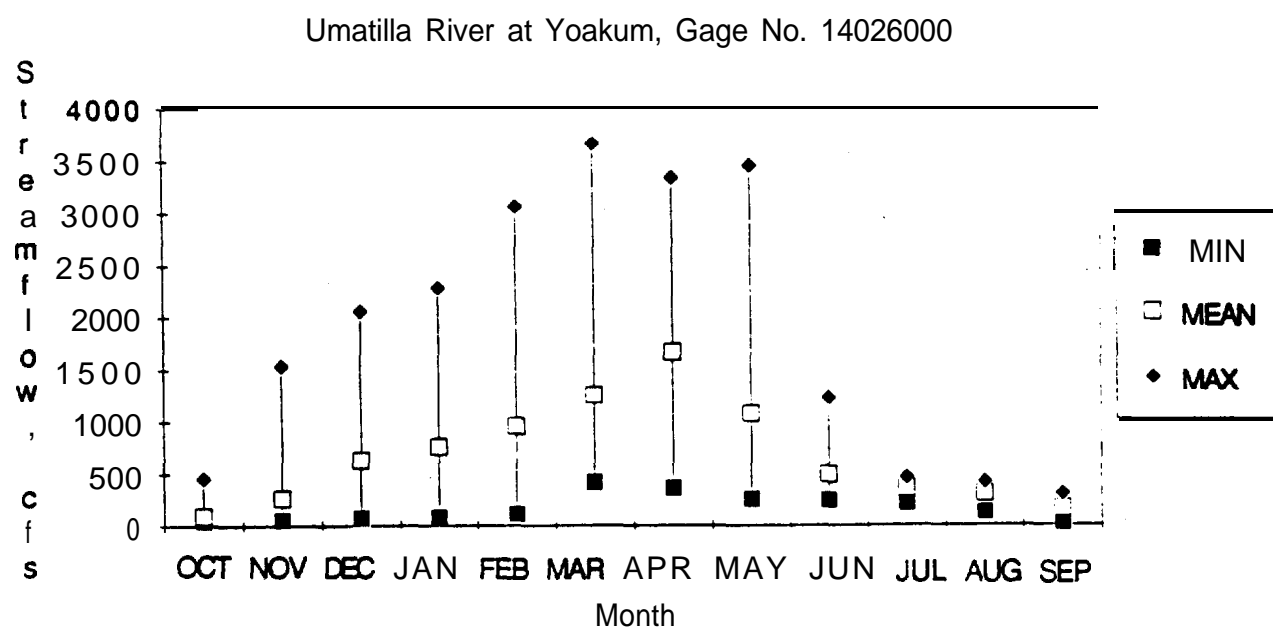
FIGURE 26  
USGS GAGE ON **UMATILLA RIVER AT PENDLETON (14021000)**  
MINIMUM STREAMFLOW



**FIGURE 27**  
**USGS GAGE ON UMATILLA RIVER ABOVE MCKAY CREEK (14022000)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**

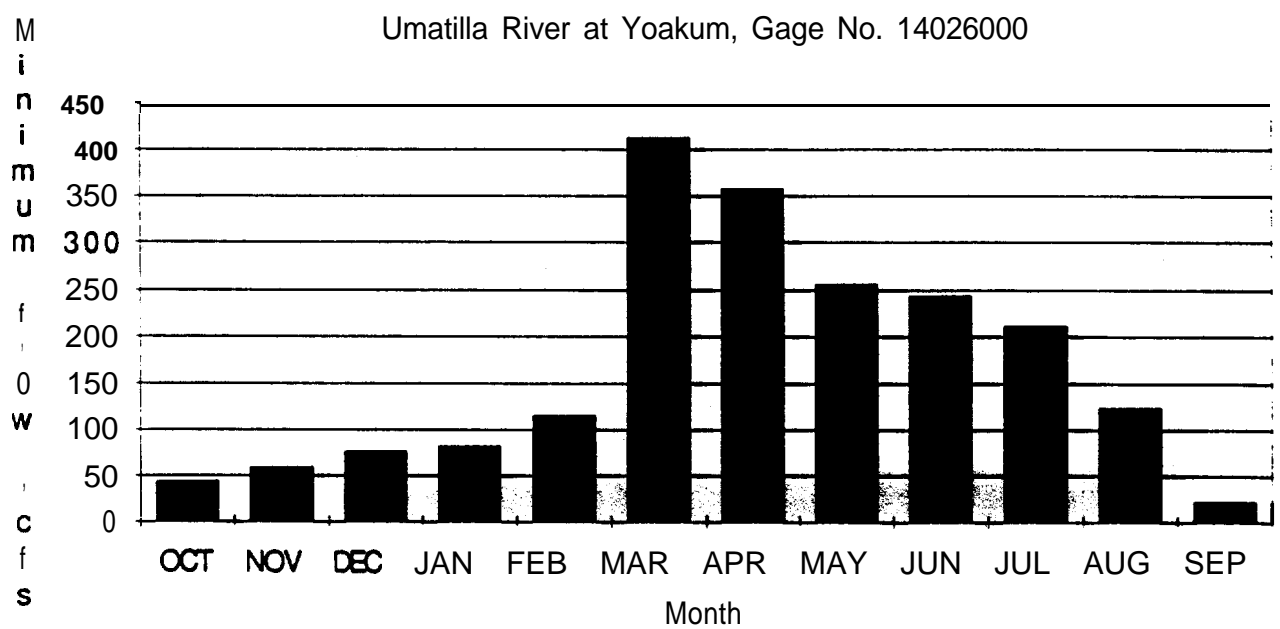


**FIGURE 28**  
**USGS GAGE ON UMATILLA RIVER ABOVE MCKAY CREEK (14022000)**  
**MINIMUM STREAMFLOW**

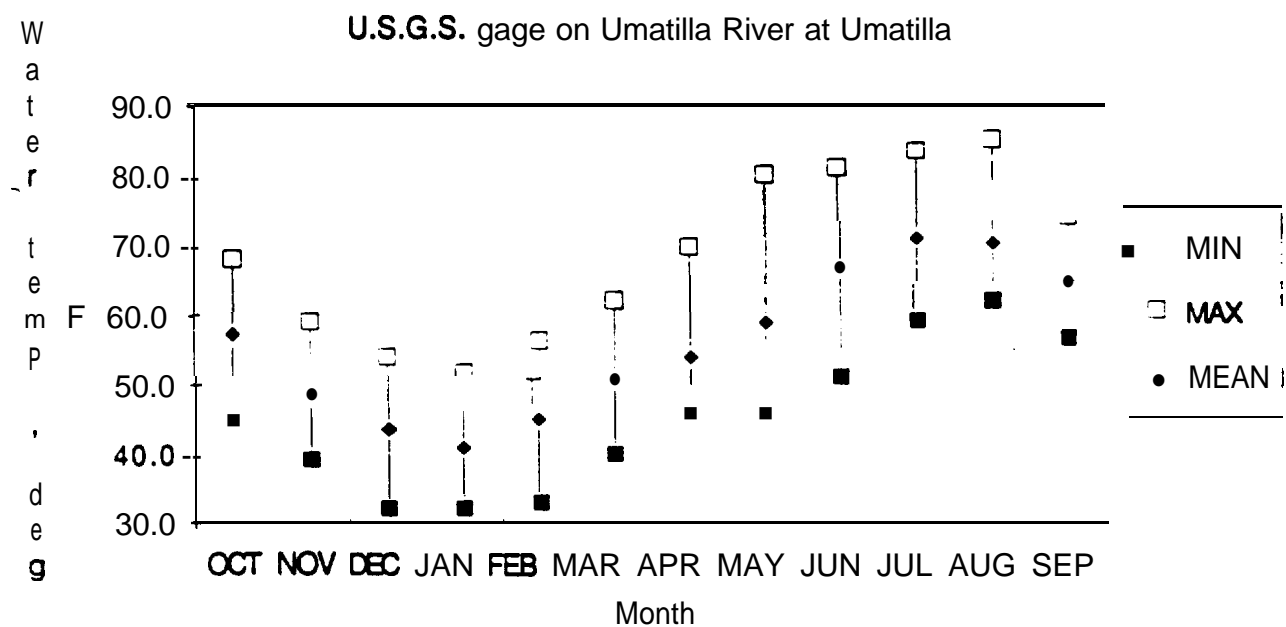
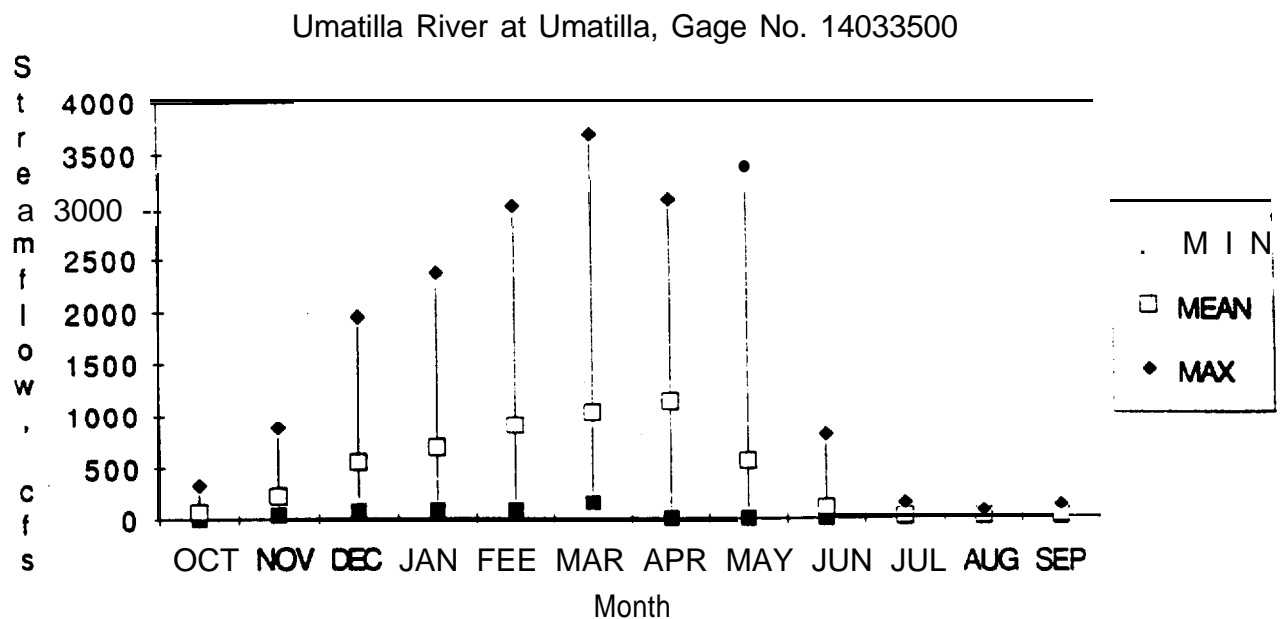


**FIGURE 29**

**USGS GAGE ON UMATILLA RIVER AT YOAKUM (14026000)**  
**MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**



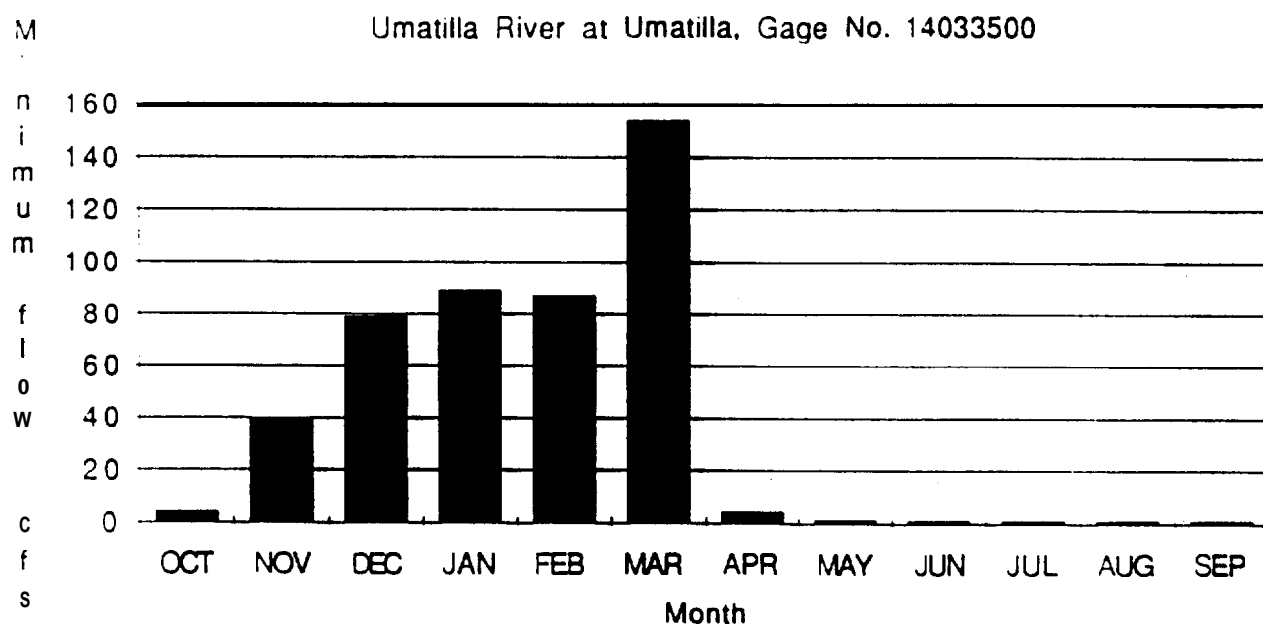
**FIGURE 30**  
**USGS GAGE ON UMATILLA RIVER AT YOAKUM (14026000)**  
**MINIMUM STREAMFLOW**



**FIGURE 31**

**USGS GAGE ON UMATILLA RIVER NEAR UMATILLA (14033500)  
MINIMUM, MEAN AND MAXIMUM STREAMFLOW AND TEMPERATURE**





**FIGURE 32**  
**USGS GAGE ON UMATILLA RIVER NEAR UMATILLA (14033500)**  
**MINIMUM STREAMFLOW**

TABLE 18

## WATER QUALITY . UMATILLA RIVER BASIN(a)

Parameters (mg/L unless otherwise noted)	Corporation (Umatilla River)	Williams (Well)	Gray (Well)	Gray (Umatilla River)	Meacham Creek below Camp Creek	Thorn Hollow (Umatilla River)	Barnhart (Umatilla River)	Minnehaha Springs	Below 3 Mile Dam (Umatilla River)
<b>Cation &amp; Anions</b>									
Sodium	2.8	34	28	3.1	2.2	2.8	5.3	35	9.4
Potassium	1.5	2.6	2.9	1.4	1.3	1.3	1.8	5.5	2.6
Calcium	4.7	3.7	4.3	4.5	4.1	4.6	7.4	46	17.0
Magnesium	1.5	<0.10	<0.10	1.6	1.6	1.8	3.2	16	5.9
Bicarbonate	24.3	75.5	85.8	24.3	24.3	24.3	42.6	249	84.9
Carbonate	0.05	8.59	3.01	0.04	0.05	0.04	0.09	0.79	0.3
Chloride	1.1	4.4	2.6	1.5	<1.0	1.2	2.5	12	5.1
Sulfate	<2.0	<2.0	<2.0	<2.0	<2.0	<2	3.6	23	8.4
Nitrate-N	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.4	7.9	1.1
Fluoride	<0.1	1.2	0.66	<0.1	<0.1	<0.1	<0.1	0.31	0.12
Hydroxide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
pH (no units)	7.6	9.3	8.8	7.5	7.6	7.5	7.6	7.7	7.8
Conductivity (mmho/cm)	51.4	165	155	52.6	45.5	53.7	88.6	515	180
Alkalinity	20	75	75	20	20	20	35	205	70
TDS	70	150	120	64	60	60	78	320	120
Hardness	18.0	9.25	10.8	17.9	16.9	19.0	31.9	182	67.1
<b>Dissolved Gases</b>									
Oxygen	12.8	7.1	1.3	12.9	12.0	12.8	13.0		12.8
Hydrogen Sulfides		present	resent						
Temperature (C)	1.8	11.3	8.2	1.9	1.6	2.3	1.4		2.4

(a) All stations sampled on 1/24/91 except Minnehaha Springs, which was sampled on 3/3/91.

## Principal diversions from the Umatilla

The principal diversions from the Umatilla River are summarized in Table 19.

**TABLE 19**  
**PRINCIPAL DIVERSIONS (CFS) FROM THE UMATILLA RIVER**

Diversions	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Furnish Canal	0.6	0	0	0	0	11	84	114	114	115	105	45
<del>Echo Canal</del>	<del>25</del>	<del>003</del>	<del>159</del>	<del>140</del>	<del>170</del>	<del>189</del>	<del>175</del>	<del>178</del>	<del>46</del>	<del>15</del>	<del>14</del>	<del>14</del>
Maxwell Canal	21	0	0	0	0	2	54	68	50	38	35	30
Western Land canal	4	3	3	1	2	47	197	200	178	183	164	81
West Division canal	94	16	3	0	3	46	142	166	160	165	165	142
<b>Total</b>	<b>156</b>	<b>122</b>	<b>165</b>	<b>144</b>	<b>179</b>	<b>293</b>	<b>668</b>	<b>736</b>	<b>579</b>	<b>516</b>	<b>483</b>	<b>312</b>

### NOTES:

1. Diversions listed are located between Yoakum and Umatilla.
2. Furnish Canal near Echo diverts from right bank of Umatilla River and delivers water to Cold Springs Reservoir.
3. Umatilla Project Feed Canal diverts from right bank of Umatilla **River** and delivers **waterto** Cold Springs Reservoir.
4. Allen Canal at Echo diverts from right bank of Western Land Canal.
5. Maxwell Canal near Hermiston diverts from right bank of Umatilla for irrigation near **Hermiston**;at times it receives water from Cold Springs Reservoir.
6. Western Land Canal near Echo diverts from left bank of Umatilla for irrigation west of Echo and **Stanfield**;ground water recharge near Ordnance.
7. West Division Main Canal near Umatilla diverts **from** left bank of Umatilla for irrigation near Irrigon and Boardman.

## Instream Flows and Water Rights

The Oregon Water Resources Commission has a policy to “support the anadromous fish production goals of the Northwest Power Planning Council, Oregon Department of Fish and Wildlife and Confederated Tribes of the Umatilla Indian Reservation for the Umatilla River Basin”. The Commission has several ways of managing the waters in the Umatilla Basin to support this policy. The Commission has established minimum perennial streamflows to help protect aquatic life in the Umatilla Basin. Under Oregon law, minimum **streamflows** are treated as natural flow rights and are regulated according to priority in the same manner as water rights. The Umatilla Basin minimum perennial streamflows have a priority date of November **3, 1983**. These minimum levels cannot always be maintained, and are typically not met in the Umatilla River between June 1 and October 31. The recommended streamflow levels will be satisfied in the South Fork **Walla Walla River** in most years. The recommended minimum perennial streamflows for the Umatilla River, South Fork **Walla Walla River** and North Fork Meacham Creek are shown in **Table20**.

The Commission may also withdraw unappropriated surface water, which effectively closes a stream or river to further appropriation during part or all of the year. The Umatilla Basin Program declares that no new appropriations will be allowed on affected streams and tributaries when

minimum streamflows are below established levels. Both the Umatilla River and tributaries, and the **Walla Walla** River and tributaries are under withdrawal **orders**. The purpose of the withdrawal is to conserve all remaining flows for **instream** purposes, and as such fish uses are exempt from the withdrawal order.

Although fisheries projects are exempt from such withdrawal orders, a permit to appropriate surface water must be granted for each project.

**TABLE 20**  
**MINIMUM PERENNIAL STREAMFLOWS (CFS)**

Stream / Location	Month											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
<b>Umatilla River</b> Below Forks	25	25	60	60	97	97	97	97	60	40	40	40
umatilla River Meacham Ck. to McKay Ck.	200	200	200	200	240	240	240	240	200	<b>100</b>	60	60
<b>Umatilla River</b> McKay Ck. to mouth	300	250	250	250	250	250	250	250	250	120	85	85
<b>NF</b> umatilla River Below Coyote Ck.	12	12	25	25	40	40	40	40	25	25	25	25
NF Meacham Ck. Below Bear Ck.	<b>10</b>	<b>10</b>	<b>40</b>	<b>40</b>	70	70	70	70	40	25	10	<b>10</b>
<b>SF Walla Walla</b> Below Elbow Ck.	5	5	25	25	36	36	36	36	25	15	15	15

### **Flood Frequency Data**

The Federal Emergency Management Agency (**FEMA**) Flood Insurance Studies for the Umatilla and **Walla Walla** drainage basins were reviewed. These reports contain flood flow **statistics** and stages in the creeks and rivers as well as floodplain boundaries (Table 21). No FEMA data exists for the Umatilla River above Pendleton.

The flooding potential at each of the proposed sites was qualitatively evaluated and rated as **low**, moderate or high. This judgement was based on field observation, local knowledge and published documentation. Low flood potential means there were no evident signs of flood potential at the site, and no documented flood history. Moderate flood potential means there is a known or documented history of moderate flooding, or the site lies within the FEMA defined **100-year** floodplain boundary, or evidence of flooding was observed in the field. Sites were rated as **having** a high flood potential if there is a known or documented history of recurrent flooding.

**TABLE 21**  
**QUALITATIVE EVALUATION OF FLOOD POTENTIAL AT PROPOSED SITES**

<b>Sites</b>	<b>Stream</b>	<b>Flood Potential</b>	<b>Site Within 100-Year Flood Boundary</b>	<b>Comments</b>
Meacham Creek at Camp Creek	Meacham Creek	Moderate	No FEMA data	some evidence of shifting channel
Corporation	Umatilla River	Low	No FEMA data	
Emmett Williams	Umatilla River	Low	No FEMA data	
Fred Gray	Umatilla River	Moderate	No FEMA data	historical bank erosion and subject to flooding at downstream end
Thorn Hollow	Umatilla River	Low	No FEMA data	relatively high bank
Cayuse	Umatilla River	Moderate	No FEMA data	evidence of unstable bank and periodic flooding
Mission	Umatilla River	Low	No FEMA data	site is 8 to 10 feet above river
ODF&W	Umatilla River	High	No FEMA data	existing berm indicates historical flooding
Barnhart	Umatilla River	High	Yes	recent flooding has occurred due to low bank
Nolin	Umatilla River	Moderate	Yes	unstable bank subject to erosion and channel shifting evident
Echo Meadows	Umatilla River	High	Yes	recent flooding and evidence of channel movement
Three Mile Dam	Umatilla River	Low	No	
South Fork Walla Walla	S. Fork Walla Walla	LOW	No	

## **SURFACE WATER SUMMARY AND RECOMMENDATIONS**

### **Gravity Surface Water Supply**

Locations potentially suitable for a gravity surface water supply have been identified at the following sites:

- Corporation,

- Emmett Williams,
- Fred Gray 80 acre,
- **ODF&W**, and
- **Meacham** Creek at Camp **Creek**.

In order to further evaluate the development potential of a gravity supply at any of these sites, **site-specific** data is required. A site survey is needed to establish the area, elevation and general topography of each site. This survey should include:

- establishing the river location relative to the site,
- establishing the potential river intake location relative to the site,
- measurement of a river cross-section between the highest points within the defined river channel section at the field identified intake location, and
- determination of the hydraulic gradient (to the nearest 0.1 ft.) from a point **500** feet upstream of the potential intake location to the downstream end of the potential facility site. Discharge data is required for the river on the day the hydraulic gradient is surveyed. This information should be obtained from the appropriate USGS or USFS stream gaging station for each site.

**Pumped surface water supply.** All other sites are presently identified as potentially most suitable for a pumped surface water supply. A gravity supply could be developed at these sites, but would require more extensive site work, in-river structures, and long supply pipelines.

In order to further evaluate the development potential of a pumped supply at any of these sites, **site-specific** data is required. The site and hydraulic gradient survey data identified above for the gravity supply analysis fulfills the information needs for a pumped water supply. The potential pumped intake location for each site needs to be identified in the field and noted on the site survey.

## **GROUNDWATER**

### **Review of Available Data**

Groundwater quantity and quality was evaluated for each **identified** potential production facility and the following is a summary of the findings for each site. The evaluation consisted of a review of driller's logs on file with the **Oregon** Department of Water Resources (ODWR); published reports by ODWR, USGS, and other agencies; and unpublished reports **from** JMM files.

**Corporation:** Two groundwater wells were identified in this area. One well log reported development to a depth of 237 feet, yielding **60 gpm** at **54°F**. The other well log reported development to 85 feet deep in fractured basalt, yielding 48 gpm at **68°F** with artesian flow at 8 psi. Potential for developing groundwater supply in excess of 1 **cfs** is considered low.

**Emmett Williams:** Two wells were identified on the Williams' property. The **Lavadour** well yielded 7 gpm at **54°C**, at **140** ft. depth in fractured gray basalt. The Emmett Williams well log reported artesian flow yield of 200 gpm at **53°F**, 15 psi. The well was drilled to a depth of 230 feet at which point it entered a layer (thickness unknown - at least 8 ft.) of red cinder and small gravel. **The** extent of this water bearing zone is unknown. Further testing would be necessary to determine potential for development of a groundwater supply from this zone, but a supply in

excess of 500 gpm may be possible. A test well is needed to determine groundwater potential at this site.

**Fred Gray - 27 and 80 Acre:** Six domestic well logs were identified in this area. All wells terminated in black or gray basalt zones at a maximum depth of 245 feet. The highest yielding well tested at 200 gpm with extreme draw down after a short pumping period. A well located on the site has a total depth of 92 ft. and yielded 30 gpm with 21 ft. **drawdown** in 2.5 hours. A temperature of 8°C was reported. It is unknown if the red cinder and small gravel zone, identified at the Emmett Williams site, exists in this area. A test well is needed to determine groundwater potential at this site.

**Meacham Creek above N. Fork Meacham Confluence:** No specific groundwater information on this site is available. The closest well logs to this site are near Bonifer.

**Meacham Creek at Camp Creek:** No specific groundwater information on this site is available. The closest well logs to this site are near Bonifer.

**Bonifer Springs:** Two wells are located approximately 1 mile downstream from Bonifer. A log of a 109 foot well reported 80 gpm at zero feet of **drawdown** after a 2 hour pump test. The log of a 164 foot well reported 27 gpm with 4 feet of **drawdown** after a 2 hour pump test. Water temperature in these wells was reported at **55°F**. Potential for developing a **500+** gpm well at the Bonifer site is considered low, but possible. A test well is needed to determine groundwater potential at this **site**, if a groundwater supply is considered to be desirable.

**Thorn Hollow:** Records of 14 domestic wells located in Sections 4 and 5 **were** evaluated. The deepest well was developed to 120 feet. The highest producing well **test** yielded 75 gpm artesian flow with a head of 8 feet in 1969. Six of the 14 wells reported artesian flow. No well water temperature was available, but it is expected to be in the mid **50°F** range. A test well is needed to determine groundwater potential at this site.

**Black Bridge:** Groundwater development is not applicable at this site.

**Cayuse Bridge:** Groundwater development is not applicable at this site.

**Homly:** Groundwater development is not applicable at this site.

**Minthorn:** **One** existing well was identified in this area. The well is reported to be developed to a depth of 80 feet with a test yield of 150 **gpm** without any recorded **drawdown** after one hour. A test well is needed to determine groundwater potential at this site.

**Mission:** Records of 6 domestic wells in this area indicated no artesian flows and sufficient groundwater supply for domestic use only. None of the wells in this area were developed to a depth greater than 84 feet. **There** are reports of **300+** ft. wells in the vicinity with yields of approximately 2 cfs. A test well is needed to determine **groundwater** potential at this site at depths below 84 feet.

**ODF&W:** Groundwater development is not applicable at this site.

**Babe Ruth:** Groundwater development is not applicable at this site.

**Riverside:** Groundwater development is not applicable at this site.

**Barnhart:** No wells were identified in this **area**.

**Nolin:** No wells were identified in area.

**Echo Meadows:** Groundwater development is not applicable at this site.

**Cottonwood Bend Area:** Well logs in this area (Section 19 and 20) reported yields of 2000 gpm with temperatures in the mid **50°F** range. These wells are located in a zone of highly permeable sediments. The source of this water is recharge from irrigation on the surrounding area. There is no potential for high **groundwater** yields from shallow wells north of Bridge Road, which is a westerly continuation of Highland Avenue in **Hermiston**, Oregon.

Minnehaha Springs yields an estimated discharge to the river of between 3 cfs and 8 cfs. The City of Hermiston has a water right on Minnehaha Springs and **ODF&W** maintained a hatch box on the springs in the past.

**Three Mile Dam:** No wells were identified in this area.

## **TEST WELL DRILLING PROGRAM**

Three test wells were constructed to evaluate groundwater production potential at three alternative Umatilla Satellite Project hatchery sites. The investigated sites were the Fred Gray and Emmett Williams sites on the Umatilla River and the Russell Walker site on the South Fork **Walla Walla** River. A fourth site, the Bar M Ranch on the Umatilla River, was not drilled based upon the results of the initial **three** wells.

Two hydrogeologic units are present at each site. The upper hydrogeologic unit is the alluvium which consists of river deposited sands and gravel with a maximum thickness of about 50 feet. The alluvium was not considered as a first-choice groundwater source due to river influences on water temperature and quality. The lower hydrogeologic unit is the Columbia River basalt. The basalt has constant temperature groundwater and was considered as the preferred groundwater source for potential disease-free egg incubation and early rearing water supplies. The basalt hydrogeologic unit is further subdivided into an shallow non-flowing or low-pressure artesian zone and a deep high-pressure artesian zone.

## **Project Scope and Schedule**

The scope of the project consisted of drilling and testing deep wells at each site to evaluate the groundwater characteristics of the basalt aquifer. Target production rate for each site was 600 to 1000 gpm. Water quality criteria called for a maximum groundwater temperature of **60°F**; lower groundwater temperatures were preferred.

The original project scope called for wells to tap both the upper and lower basalt zones. However, CTUIR Water Resources personnel were concerned with the potential problems resulting from water level interference with existing domestic wells completed in the upper basalt zone. As a result, the scope of the project was modified to test only the deep aquifer zone, with casing sealed to a minimum depth of 150 feet at each site.

Following well construction, each well was tested to determine aquifer production potential. During each well test, groundwater temperature, conductivity, **pH** and hydrogen sulfide were measured in the field, and water samples for laboratory analysis **were** obtained.

The project was authorized on June 12 by Bonneville Power Administration. Start of the project was delayed by difficulties obtaining permits for the test wells from Tribal Water Resources. Permits were obtained on August 16, and the drilling contractor, Larry Burd Well Drilling,



commenced drilling on October 15, 1991. Burd completed drilling on January 3, 1992. Rump testing was completed on January 17, 1992. Drilling of the fourth well (Bar M Ranch) was canceled based upon results of the first three wells.

The test wells were **8-inch** diameter and ranged in total depth from 280 to 450 feet. To avoid interfering with existing nearby domestic wells, each well had a minimum of 150 feet of **8-inch** steel casing which was sealed to the surface with cement grout. Below the **8-inch** casing, the wells were completed as open boreholes.

**Gray Test Well.** The Gray Test Well was drilled to a total depth of 370 feet. The well will flow for short-durations at rates in excess of 1400 gpm. Shut-in pressure exceeds 60 psi. Projected long-term production from the deep basalt aquifer at the site is 1000 gpm from a single well and 1500 gpm from multiple wells. Water temperature is **57°F**, and the water contains approximately 0.3 ppm hydrogen sulfide.

The Gray Well was initially constructed with **8-inch** casing cemented to 150 feet. However, the open well bore below the **8-inch** casing provided a hydraulic connection between high pressure artesian zones (located below 300 feet) and non-artesian **zones** (located above 200 feet). As a result, two nearby private wells began to flow when the Gray Well was shut-in. To remedy this situation, a drillable plug was installed in the well and **6-inch** casing was cemented in place **from 300 feet to the surface**. The well is presently plugged but can be rehabilitated by removal of the drillable plug.

**Williams Test Well.** The Williams Test Well was drilled to a total depth of 280 feet. Shut-in pressure is approximately 88 psi and short-duration artesian flow rates exceed 1000 gpm. Projected long-term production from the deep basalt aquifers at the site is 1200 gpm **from** a single well and 1800 gpm from multiple wells. Water temperature is **56°F**, and the water contains approximately 3 ppm hydrogen **sulfide**.

**Walker Test Well.** The Walker Test Well was completed to a total depth of 450 feet. Shut-in pressure is approximately 25 psi and short-duration artesian flow rates exceed 500 gpm. Projected long-term production from the deep basalt aquifers at the site is 250 gpm **from** a single well and 400 gpm from multiple wells. Water temperature is **68°F**, and the water contains approximately 1 ppm hydrogen sulfide.

## **Conclusions and Recommendations**

Tests of the deep basalt aquifer at the Emmett Williams and Fred Gray sites indicate that groundwater, in sufficient quantities for the proposed hatchery needs, can be developed from the deep basalt aquifer at the Emmett Williams and Fred Gray sites. However, hydrogen sulfide in groundwater produced from the deep basalt aquifer at these sites would require treatment for hatchery use.

Aquifer testing at the Russell Walker site suggests that groundwater from the deep basalt aquifer may not be available in sufficient quantities for hatchery needs. The temperature of the deep basalt groundwater is too **warm** for the proposed use and hydrogen **sulfide** would require treatment for hatchery use.

Alternative groundwater sources include the shallow basalt at the Fred Gray site and alluvium at all identified sites.

Additional investigation will be required to confirm the quantity, temperature and quality of groundwater derived from the alluvium or shallow basalt. We recommend that additional groundwater investigation be conducted prior to or during the design phase.

The alluvial groundwater investigation at the preferred alternative site would start with a geophysical investigation to determine the bedrock profile. Following the geophysical investigation, a number of shallow wells and piezometers would be drilled for evaluation of aquifer characteristics. We anticipate that the average well and piezometer depth would be thirty feet or less. For predesign purposes, some of the piezometers and test wells would also be useful for monitoring of groundwater levels beneath selected site facilities.

If the Fred Gray site is chosen as the preferred alternative, we recommend a shallow basalt groundwater evaluation in addition to the alluvial groundwater investigation. The shallow basalt evaluation probably would not involve drilling. Instead, one or more existing domestic wells in the area could be pump-tested to determine aquifer characteristics. Potential wells for testing include the **Picard**, Kirksey, and **McBean** wells. Based upon the results of the testing, estimates could be made regarding quantity of groundwater available for hatchery supply purposes.

# **REVIEW OF EXISTING FACILITIES AND ASSESSMENT OF EXPANSION POTENTIAL**

## **INTRODUCTION**

Implementation of the Umatilla **Subbasin** Plan will require additional hatchery production and related fisheries facilities. The purpose of this section is to review and assess the expansion potential of existing hatcheries and facilities in the Columbia River Basin. The use or expansion of existing **facilities** (if possible) may offer significant economic saving in capital and operating costs. The information presented in this section is based on published information, site visits, and discussion with agency, tribal, and fisheries personnel.

The following hatcheries/fisheries facilities have been evaluated for use in the implementation of the Umatilla **Subbasin** Plan:

- **Wallowa** Hatchery
- Lookingglass Hatchery
- Irrigon Hatchery
- Umatilla Hatchery
- Lyons Ferry **Salmon** Hatchery
- Bonifer Springs Acclimation and Release Pond
- **Minthorn** Acclimation and Release Pond
- Springfield **Aquaculture** Facility (formerly Ore Aqua)

## **ASSESSMENT OF EXPANSION POTENTIAL**

### **Wallowa Hatchery**

#### **Hatchery Data**

Location:	Enterprise, Oregon
Distance from Pendleton:	<b>97 miles</b>
Operating Agency:	<b>ODF&amp;W</b>
Funding Agencies:	COE <b>USF&amp;WS under LSRCF</b> ODF&W
<b>Species Reared:</b>	summersteelhead

	Resident Trout
	Resident Coho
Type of Rearing System	Single-Pass Raceways
	Acclimation Ponds for <b>StSu</b>
Water Supply	Groundwater
	Springs
	<b>Spring Creek</b>
	<b>Wallowa River</b>
Expansion Potential	
<p>The expansion of this hatchery would require additional water, which does not appear to be available. Spring Creek is <b>also</b> seriously impacted by agricultural run-off. Low flows and high temperatures are experienced during the summer. Ponds often freeze over during the winter. Increased flows in the <b>Wallowa</b> River could allow increased production at this hatchery.</p>	

#### Additional Information:

Assessment of Present Anadromous Fish Production Facilities in the Columbia River Basin, Volume 3, Bonneville Power Administration.

### Lookingglass Hatchery

#### Hatchery Data

Location:	Lookingglass Creek near Elgin, Oregon
Distance from Pendleton:	<b>59 miles</b>
<b>Operating Agency:</b>	<b>ODF&amp;W</b>
Funding Agency:	<b>USF&amp;WS</b> under LSRCF
<b>Species Reared:</b>	Spring Chinook
Type of Rearing System	Single Pass Raceway
water Supply	Groundwater
	<b>Lookingglass Creek</b>

#### Expansion Potential

The operation of this hatchery is complicated by winter access problems, icing in Lookingglass Creek, and low water temperatures that limit fish growth in winter and early spring. The expansion of this hatchery would require additional raceway

space. Development of additional raceways could require relocation of existing staff housing. It is not known if any new production units at this facility could be used for **non-LSRCP** production in the Umatilla Basin.

Additional Information:

Assessment of Present Anadromous Fish Production Facilities in the Columbia River Basin, Volume 3, Bonneville Power Administration.

### **Irrigon Hatchery**

Hatchery Data

Location:	Irrigon, Oregon
Distance from Pendleton:	51 miles
<b>Operating Agency:</b>	ODF&W
Funding Agency:	<b>USF&amp;WS</b> under LSRCP
Species <b>Reared:</b>	Fall Chinook Spring Chinook <b>Summer Steelhead</b>
Type of Rearing System	Two-pass Standard Oregon Raceways
water Supply	Groundwater

Expansion Potential

The expansion of this hatchery would require additional water and space. If oxygen supplementation is proven effective and/or additional water is developed, this facility could have the potential to increase production. It is not known if any new production units at this facility could be used for non-LSRCP production in the Umatilla Basin.

Additional Information:

Assessment of Present Anadromous Fish Production Facilities in the Columbia River Basin, Volume 3, Bonneville Power Administration.

### **Umatilla Hatchery**

Hatchery Data

Location:	<b>Irrigon, Oregon</b>
Distance from Pendleton:	51 miles
Operating Agency:	<b>ODF&amp;W/CTUIR</b>

Funding Agency:	Bonneville Power Administmtion
Species <b>Reared:</b>	Fall Chinook Spring Chinook <b>Summer Steelhead</b>
Type of Rearing System	Two-pass Standard Oregon Raceways Three-pass Michigan Raceways with Supplemental Oxygen
water Supply	Groundwater

#### Expansion **Potential**

This hatchery is testing the use of supplemental oxygen to increase the production of fall and spring chinook. If oxygen supplementation is proven effective, production could be expanded by construction of additional raceways. Because of the duration of the oxygen experiment, the potential expansion of this hatchery would not be possible for at least 5-6 years.

#### Additional Information:

Umatilla Fish Hatchery - Construction Drawing. 1989. **U.S.Corps** of Engineers, **Walla Walla District, Walla Walla**

Umatilla Hatchery Master Plan. 1989. Prepared by the Oregon Department of Fish and Wildlife and The Confederated Tribes of the Umatilla Indian Reservation. Prepared for the Northwest Power Planning Council.

Evaluation of the Pure Oxygen System at the Umatilla Hatchery. 1991. Fish Factory, Prepared for Bonneville Power Administration.

### **Lyons Ferry Salmon Hatchery**

#### Hatchery Data

Location:	Starbuck, Washington
Distance from Pendleton:	<b>96 miles</b>
<b>Operating Agency:</b>	WDF
Funding Agency:	<b>USF&amp;WS</b> and COE
Species Reared:	Fall Chinook Spring Chinook
Type of Rearing System	Singe-pass early rearing raceway Large Ponds (3)

Water Supply

Groundwater

Expansion Potential

The expansion of this hatchery would require additional **groundwater**. The amount of additional available groundwater is unknown. Because only 3 large ponds are available for **fry** rearing, species/stock isolation and segregation may be difficult at this hatchery

Additional**Information:**

Assessment of Present Anadromous **Fish** Production Facilities in the Columbia River Basin, Volume 4, Bonneville Power **Administration**.

### **Bonifer Springs Acclimation and Release Pond**

Hatchery Data

<b>Location:</b>	Meacham Creek, River Mile 2.0
Distance <b>from</b> Pendleton:	<b>25 miles</b>
<b>Operating Agency:</b>	<b>CTUIR</b>
Funding Agency:	Bonneville Power Administration
Species Reared:	Summer Steelhead (adult holding) Summer Steelhead (acclimation) Fall Chinook (acclimation) Spring Chinook ,
Type of Rearing System	Single-pass pond
<b>Water Supply</b>	Spring water

Expansion Potential

This facility is used for adult capture of summer steelhead, holding of adult summer steelhead, and acclimation and release of fall and spring chinook and summer steelhead. Disease problems with **"Ich"**, low dissolved oxygen concentrations, and release have been experienced at this facility. Recommendations for the improvement and expansion of the capacity of this facility for adult holding and acclimation have been developed by Fish Management Consultants (1989). These recommendations if implemented, will improve the operation and capacity of this facility for acclimation.

This facility does not have enough water for adult holding of fall and spring chinook under the Umatilla **Subbasin** Plan or for incubation and rearing of the NEOH portion of the Umatilla Basin

Additional**Information:**

Operation, Maintenance and Evaluation of the Bonifer and Minthom Springs Juvenile Release and Adult Collection Facilities, 1988. Bonneville Power Administration

Review of Bonifer Springs Culture Operation with Recommendations. 1989. Fish Management Consultants, Prepared for the Confederated Tribes of the Umatilla Indian Reservation.

### **Minthorn Acclimation and Release Pond**

#### Hatchery Data

Location:	Umatilla River, River Mile 63.7
Distance from Pendleton:	10 miles
<b>Operating</b> Agency:	<b>CTUIR</b>
Funding Agency:	Bonneville Power Administration
Species <b>Reared</b> :	Summer Steelhead (adult holding)
	Summer Steelhead (acclimation)
	Fall Chinook (acclimation)
<b>Water Supply</b>	Spring water

#### Expansion Potential

This facility is used for adult capture of summer steelhead, holding of adult summer steelhead, and acclimation and release of fall chinook and summer steelhead. Disease problems with "**Ich**", low dissolved oxygen concentrations, high water temperatures, and low water flows have been experienced at this facility. Recommendations for the improvement and expansion of the capacity of this facility for adult holding and acclimation have been developed by Fish Management Consultants (1989). These recommendations, if implemented, will improve the operation and capacity of this facility for adult holding and spawning and juvenile acclimation for a relatively small additional number of steelhead.

This facility does not have enough **water** for adult holding of fall and spring chinook under the Umatilla **Subbasin** Plan or for incubation and rearing of the NEOH portion of the Umatilla Basin.

#### Additional Information:

Operation, Maintenance and Evaluation of the Bonifer and Minthom Springs Juvenile Release and Adult Collection Facilities, 1988. Bonneville Power Administration

Minthom Facility Evaluation. 1989. Fish Management Consultants, Prepared for the Confederated Tribes of the Umatilla Indian Reservation.



## Springfield Aquaculture Facility

### Hatchery Data

Location:	Springfield, Oregon
Distance from Pendleton:	356 miles
<b>Operating Company:</b>	<b>Alleco</b> Financial Corporation
Species Reared:	Coho Chinook
Type of Rearing System	Single-pass raceway system with oxygen supplement
Adult Holding Capacity	50,000 adult fish
Incubation Capacity	<b>25,000,000</b> eggs
Maximum Rearing Capacity:	500,000 lb
Maximum Yearly Rearing Capacity:	<b>1,200,000</b> lb
Water Supply	McKenzie River Heated Process water from paper mill

### Expansion Potential

This is a productive and effective large-scale hatchery. It has the ability to mix river and heat process water to adjust hatchery water temperature. All **influent** water is disinfected with chlorine prior to use. This hatchery has one of the lowest cost per smolt ratios in the industry. Species/stock isolation can be maintained from adult holding through rearing. This hatchery is 356 miles from Pendleton. The use of this facility for rearing would probably require the use of extended **rearing/acclimation** sites for any fish transported into the Umatilla Basin.

This hatchery has good potential for the Umatilla and NEOH projects. Because of the size of this facility, the utilization of this facility for other state, federal, and tribal programs should be considered

This hatchery is available for purchase at the present time. Any decisions about potential purchase of this hatchery are time critical

### Additional **Information:**

Spring Hatchery Presentation. 1991. Alleco Financial Corporation. Prepared for The Columbia River Inter-Tribal Fish Commission.

Letter to Mr. Jerry Bauer, dated April 2, 1991 from Mr. Ron Mayo, James M. Montgomery, Consulting Engineers, Inc., **Bellevue**, Washington.

## **Overall Assessment of Expansion Potential of Hatcheries and Other Fisheries Facilities**

The following hatcheries/fisheries facilities have been considered for use in the implement of the Umatilla **Subbasin** Plan:

- **Wallowa** Hatchery
- Lookingglass Hatchery
- Irrigon Hatchery
- Umatilla Hatchery
- Lyons Ferry Salmon Hatchery
- Bonifer Springs **Acclimation and Release Pond**
- **Minthorn** Acclimation and Release Pond
- Ore Aqua Hatchery

With the exception of the Springfield **Aquaculture** Facility there is little near-term (within **5** years) potential for expansion of these hatcheries/fisheries facilities. The Springfield facility is somewhat distant from the Umatilla Basin, but may offer potential for the Umatilla and NEOH programs.

## SITE EVALUATION AND SCREENING

### INTRODUCTION

This section presents information that relates potential sites in the Umatilla River Basin to various program options available to meet the production objectives stated in the Umatilla Basin Master Plan. The information presented includes:

- the initial and revised Master Site Lists
- the site data collected during initial site **reconnaissance** visits (Appendix A), and
- site and facility screening evaluation matrices.

This information was presented to the Umatilla River Technical Work Group at the Site Workshop held on February 20 and **25, 1991** at the **CTUIR** headquarters at Mission.

### MASTER SITE LIST

Following meetings with BPA, **CTUIR**, and ODF&W, 26 sites were identified on the Umatilla River for initial analysis. One additional site, the area termed Cottonwood Bend (including Steelhead Park) at approximately river miles 11 to 13, was added following identification of potential groundwater sources in the area. Table 22 lists these sites and their approximate location on the Umatilla **River**.

### INITIAL SITE RECONNAISSANCE

Members of the consulting team conducted initial site visits in January and February. All sites were visited by, at minimum, one biologist and one engineer **from** the consulting team. General site physical and environmental characteristics were noted and a gravity and groundwater supply evaluation were conducted. Preliminary surveying was conducted to establish the general topography of the site as well as assist in the gravity water supply evaluation. All sites were recorded on videotape. Data developed through the site visits as well as collection of existing information on the sites was **summarized** in tabular form and this site data is contained in Appendix A.

**TABLE 22**  
**INITIAL SITE LIST**

<b>Site Name</b>	<b>River Mile (a)</b>
North <b>Fork</b> Meacham <b>Creek</b>	15 (Meacham Creek)
Meacham Creek at Camp Creek	11 (Meacham Creek)
Meacham Creek at Bonifer Springs	2.5 (Meacham Creek)
<b>Meacham</b> Creek at Umatilla River	79 (approximate)
<b>Corporation</b>	89
<b>Emmett Williams</b>	81
FredGray-27acres	80
Fred Gray - 80 acres	80
Thorn Hollow	72
Black Bridge - <b>Cayuse</b>	70
Homly	69
<b>Cayuse</b> Bridge	67.5
Umatilla River near Minthom	65 (approximate location)
Mission	61
<b>ODF&amp;W</b>	56.2
<b>Riverside</b>	56
Babe Ruth	52
<b>Barnhart</b>	43.25
Nolin	35
Echo Meadows ( <b>below</b> I-84 bridge)	23-24
Minnehaha Springs	11
Stanfield	23
Minnehaha Springs	11
Cottonwood Bend Area	11 - 13
<b>Three Mile Dam</b>	3
Umatilla Boat Ramp	0.25

(a) River miles based on USGS 7.5' topographic map series and/or Oregon Water Resources Department 1988 map of the Umatilla Drainage Basin.

## INITIAL SITE AND FACILITY SCREENING

The initial site and facility screening for the Umatilla River was conducted by comparing the water and space requirements for a particular type of facility with the information developed during the initial site visits (Table 23). In cases where one or more water or space requirements appeared to be precluded at a site, this site was eliminated from the list for a particular type of facility and the major reason(s) for eliminating the site noted.

In several cases, the available surface and ground water data did not allow a clear decision. In these cases, the information was noted as “to be determined” and would be developed during subsequent site visits or data gathering efforts.

Two additional facility categories are shown on Table 23: “Alternative Techniques” and “High Tech Facility”. Alternative techniques include ways of accomplishing the objectives of a particular facility type using techniques that are not necessarily spelled out in the Basin Master Plan. This category was included at this time, but no techniques spelled out, to indicate the possibility of using alternative techniques should the program require them

The High Tech Facility category includes ways to use a particular site that may otherwise be marginal or unacceptable on the basis of factors such as water quantity, water temperature, disinfection requirements, or other considerations. As shown on Table 23, several of the upriver sites (Corporation through Fred Gray - 80 acres) have the potential for incubation and rearing using river water with disinfection and, during certain times of the year, cooling as part of facility design. This would avoid the need to locate and develop an acceptable groundwater supply. Three Mile Dam could potentially be used for adult holding (given adequate space for expansion) with provisions for cooling a river water supply. If Umatilla stocks are managed as a single stock, holding adults to maturation at the site they are collected would reduce the stress of transport to an upriver site.

## RESTATEMENT OF MASTER SITE LIST

Following meetings with BPA, **CTUIR**, and **ODF&W**, 19 sites were identified as having the potential for further investigation. These sites make up the revised Master Site List (Table 24). Those sites eliminated **from** the initial Site List included:

- **North Fork** Meacham Creek,
- Fred Gray - 27 acres,
- **Homly**,
- Riverside, and
- **Stanfield**.

Table 25 presents a summary of the facility types that have been determined to have potential at each site based on reconnaissance visits to the sites, screening conducted during the initial site analysis, and the results of the initial site workshop.

**TABLE 23**  
**SITE AND FACILITY SCREENING**

SITE	FACILITY								
	Adult Capture	Adult Holding	Incubation & Fry Rearing	Satellite Rearing	Direct Release	Acclimation	Hatchery	Alternative Techniques	High Tech Facility
1. North Fork Meecham Creek	no see for capture	yes	yes with treatment	Temperature - yes Flow - not determined (not full program)	yes	no	no	not determined	not determined
2. Meecham Creek at Camp Creek	no see for capture	not determined	yes with treatment	Temperature - yes Flow - not determined (not full program)	yes	1 - 2	potential with treatment	not determined	not determined
3. Meecham Creek at Bonifer Springs	yes existing facility	not determined	yes	Temp - not determined Flow - not determined	yes	1 - 2	potential needs data on groundwater	not determined	not determined
4. Corporation North Fork Water Supply  Combined North and South Fork Supply	no see for capture	yes  CHS - yes CHF - yes	no see for capture yes with treatment	Temperature - yes Flow - no Temperature - yes Flow - yes	yes	no see for capture 1 - 2	no see for capture potential with treatment	not determined	Disinfection Cooling Small Facility
5. Emmett Williams	yes	CHS - yes CHF - yes	yes	Temp - not determined Flow - yes	yes	4	potential needs data on groundwater	not determined	Disinfection Cooling
6. Fred Gray - 27 acres	yes	CHS - yes CHF - yes	not determined needs data on groundwater	Temperature - no Flow - yes	yes	4	potential needs data on groundwater	not determined	Disinfection Cooling
7. Fred Gray - 80 acres	yes	CHS - yes CHF - yes	not determined needs data on groundwater	Temperature - no Flow - yes	yes	4	potential needs data on groundwater	not determined	Disinfection Cooling
8. Thorn Hollow	no see for capture	no see for capture	not determined needs data on groundwater	Temperature - no Flow - yes	yes	4	potential needs data on groundwater	not determined	not determined
9. Black Bridge - Coyote	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	yes	no see for capture	no see for capture	not determined	not determined
10. Hornly	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	no see for capture	no see for capture	no see for capture	not determined	not determined
11. Minthorn	yes existing facility	no see for capture	yes	Temperature - yes Flow - yes with improvements	yes	1	potential needs data on groundwater	not determined	not determined
12. Mission	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	yes	1 - 2	no see for capture	not determined	not determined
13. Riverside	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	yes	no see for capture	no see for capture	not determined	not determined
14. Barnhart	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	yes	1 - 2	no see for capture	not determined	not determined
15. Nolin	no see for capture	no see for capture	no see for capture	Temperature - no Flow - yes	yes	4	no see for capture	not determined	not determined
16. Stanfield	no see for capture	no see for capture	no see for capture	Temperature - no Flow - no	yes	no see for capture	no see for capture	not determined	not determined
17. Cottonwood Bend	no see for capture	yes need groundwater supply	yes need groundwater supply	Temperature - yes Flow - yes need to verify	no see for capture	no see for capture	potential needs data on groundwater	not determined	not determined
18. Three Mile Dam	yes existing facility	CHS - no CHF - yes	no see for capture	Temperature - no Flow - not determined	yes	no see for capture	no see for capture	not determined	Adult Holding Cooling
19. Umatilla Boat Ramp	no see for capture	no see for capture	no see for capture	Temperature - no Flow - no	yes	no see for capture	no see for capture	not determined	not determined

**TABLE 24**  
**REVISED MASTER SITE LIST**

<b>Site Name</b>	<b>River Mile (a)</b>
<b>Meacham Creek at Camp Creek</b>	11 ( <b>Meacham Creek</b> )
<b>Meacham Creek at Bonifer Springs</b>	2.5 ( <b>Meacham Creek</b> )
Corporation	89
<b>Emmett Williams</b>	81
<b>Fred Gray - 80 acres</b>	80
Thorn Hollow	72
Black Bridge	70
<b>Cayuse Bridge</b>	67.5
Umatilla River near Minthom	65
Mission	61
<b>ODF&amp;W</b>	56.2
Babe Ruth	52
<b>Barnhart</b>	43.25
<b>Nolin</b>	35
Echo Meadows (below I-84 bridge)	23-24
<b>Minnehaha Springs</b>	11
Cottonwood Bend Area	11-13
<b>Three Mile Dam</b>	3
<b>Umatilla Boat Ramp</b>	0.25

(a) River miles based on USGS 7.5' topographic map series **and/or Oregon Water** Resources Department 1988 map of the Umatilla Drainage Basin.

**TABLE 25**  
**SITE AND FACILITY SUMMARY**  
**REVISED MASTER SITE LIST**

SITE	FACILITY								
	Adult Capture	Adult Holding	Incubation & Fry Rearing	Satellite Rearing	Direct Releases	Acclimation	Hatchery	Alternative Techniques	High Tech Facility
1. Meacham Creek at Camp Creek					yes	yes		not determined	not determined
2. Meacham Creek at Bonifer Springs	yes existing facility	not determined			yes	yes	potential needs data on groundwater	not determined	not determined
3. Corporation North Fork Water Supply		yes			yes			not determined	Adult holding with cooling Small hatchery with disinfection and cooling
Combined North and South Fork Supply		yes	yes with treatment	yes		yes	potential with treatment	not determined	
4. Emmett Williams	yes	yes	yes with treatment or groundwater	yes need temp. info.	yes	yes	potential needs data on groundwater	not determined	Disinfection Cooling
5. Fred Gray - 80 acres	yes	yes	not determined needs data on groundwater		yes	yes	potential needs data on groundwater	not determined	Disinfection Cooling
6. Thorn Hollow			not determined needs data on groundwater		yes	yes	potential needs data on groundwater	not determined	not determined
7. Black Bridge - near Cayuse					yes			not determined	not determined
8. Cayuse Bridge					yes	potential			
9. Minthorn	yes existing facility		yes	yes with flow improvements	yes	yes	potential needs data on groundwater	not determined	not determined
10. Milson					yes	yes		not determined	not determined
11. ODF&W					yes	yes		not determined	not determined
12. Babe Ruth					yes				
13. Barnhart					yes	yes		not determined	not determined
14. Nolin					yes	yes		not determined	not determined
15. Echo Meadows					yes	potential		not determined	not determined
16. Minnehaha Springs		potential	potential	potential	yes	yes		not determined	not determined
17. Cottonwood Bend		yes need groundwater supply	yes need groundwater supply	Temperature - yes Flow - yes need to verify		potential need access to river	potential needs data on groundwater	not determined	not determined
18. Three Mile Dam	yes existing facility	CHF - yes						not determined	Adult Holding Cooling
19. Umatilla Boat Ramp					yes				
20. Russell Walker Property S. Fork Walla Walla River		yes	yes	yes	may be needed for NEOH project		yes		



## **SITE/PROGRAM FEASIBILITY ANALYSIS**

**Each** facility type was further evaluated at potential sites through an analysis of environmental and engineering criteria. All facility types shown on Table 25 **were** evaluated with the exception **of**:

- Direct Release - adequate space is really the only issue here and all sites are **acceptable**,
- Hatchery - development of a hatchery in the Umatilla Basin is dependent on NEOH siting and will occur later in the **project**,
- **Alternative** Techniques - presented as an option for informational purposes only, **and**
- High Tech Facility - also presented as an option for **informational** purposes only.

Tables 26 through 30 present the results of these evaluations.

TABLE 26 (1 of 2)

## ADULT CAPTURE SCREENING CRITERIA

	Meacham Creek at Bonifer Springs		Emmett Williams		Fred Gray - 80 acres	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b>						
1. Disease potential	n/a	n/a	n/a	n/a	n/a	n/a
2. Water temperature	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
3. General minerals	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
4. Other pollutants (phosphate, oil & grease)	None identified	None identified	None identified	None identified	None identified	None identified
5. Offsite risks	Adjacent to RR ROW	Adjacent to RR ROW	None identified	None identified	None identified	None identified
<b>II. WATER QUANTITY</b>						
6. Availability	Approx. 2 cfs from Springs	Approx. 2 cfs from Springs	35-44 cfs during period	35-44 cfs during period	35-44 cfs during period	35-44 cfs during period
7. Dependability	Good	Good	Good	Good	Good	Good
8. Intake structure	Poor, bedload movement	Poor, bedload movement	Good, 500 ft. upriver	Good, 500 ft. upriver	Good, at upstream boundary	Good, at upstream boundary
9. Pipeline ROW	Good, pass under RR	Good, pass under RR	Good, bury in road	Good, bury in road	Good, bury in pasture	Good, bury in pasture
10. Bypass reach (length and location)	undetermined	undetermined	Approx. 500 ft. if gravity	Approx. 500 ft. if gravity	Approx. 500 ft. if gravity	Approx. 500 ft. if gravity
11. Pumped versus gravity source	Pump if use Creek	Pump if use Creek	Either	Either	Either	Either
12. Cost of water supply (construction, O&M)	High	High	High	High	Moderate	Moderate
<b>III. LOCATION ON RIVER</b>						
13. River mile	2.5 (Meacham Creek)	2.5 (Meacham Creek)	81	81	80	80
14. Spawning distribution (natural run)	Do not reach site	Typically reach site	Near limit of upstream dist.	Typically reach site	Near limit of upstream dist.	Typically reach site
15. Attraction potential	n/a	Good, with spring water	n/a	Good	n/a	Good
<b>IV. 16. PERIOD OF USE</b>						
	Sept. - Dec	Apr. 15 - Jul 15	Sept. - Dec	Apr. 15 - Jul 15	Sept. - Dec	Apr. 15 - Jul 15
<b>V. ENVIRONMENTAL CONCERNS</b>						
17. Wetlands (other than riparian zone)	Bonifer Springs	Bonifer Springs	Minimal	Minimal	Minimal	Minimal
18. Terrestrial wildlife and habitats	inferous forest, grassland	Coniferous forest, grassland	Mixed forest, cleared land	Mixed forest, cleared land	Mixed forest, cleared land	Mixed forest, cleared land
19. Threatened/endangered species	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
20. Water quality impacts of facility	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
21. Community impacts	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
22. Scenic/Aesthetic	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
23. Accessibility	gravel road to site	gravel road to site	paved road to site	paved road to site	paved road to site	paved road to site
<b>VI. SIZE OF PARCEL</b>						
24. Space for raceways/ ponds	n/a	n/a	10 acres	10 acres	80 acres	80 acres
25. Space for sedimentation ponds	n/a	n/a	10 acres	10 acres	80 acres	80 acres
26. Space for trapping	n/a	yes - existing facility	n/a	yes	n/a	yes
<b>VII. SITEWORK COSTS</b>						
27. Topography	Mostly flat	Mostly flat	Flat, steep bank at river	Flat, steep bank at river	Flat	Flat
29. Contouring and diking (flood control)	Minimal	Minimal	Minimal	Minimal	Moderate	Moderate
29. Pipeline and intake structure	Moderate	Moderate	High	High	Moderate	Moderate
30. Utilities	3 phase power to site	3 phase power to site	3 phase power to site	3 phase power to site	3 phase power to site	3 phase power to site
31. Costs of acquiring site	unknown	unknown	unknown	unknown	unknown	unknown
32. Soils/Groundwater	rocky/existing springs	rocky/existing springs	Alluvial/good gw potential	Alluvial/good gw potential	Alluvial/some gw potential	Alluvial/some gw potential
33. Access	gravel road to site	gravel road to site	Paved road to site	Paved road to site	Paved road to site	Paved road to site
<b>VIII. 34. PUBLIC EDUCATION/ACCESS</b>						
	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b>						
35. Intake structure and water supply	Required	Required	Required	Required	Required	Required
36. Pipeline	Required	Required	Required	Required	Required	Required
37. Raceways/ponds	Required	Required	Required	Required	Required	Required
<b>X. PERMITTING</b>						
38. Land Use	Existing facility	Existing facility	G-1, CTUIR	G-1, CTUIR	G-1, CTUIR	G-1, CTUIR
39. Shorelines Designation	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
40. Flood hazard	Low	Low	Low	Low	Low	Low
<b>XI. PROPERTY OWNERSHIP</b>						
41. Facility site	Private	Private	Private - Emmett Williams	Private - Emmett Williams	Private - Fred Gray	Private - Fred Gray
42. Pipeline ROW and intake structure	Private	Private	Umatilla County ROW	Umatilla County ROW	Private - Fred Gray	Private - Fred Gray
43. Time to acquire site	Unknown	Unknown	Unknown	Unknown	unknown-willing seller	unknown-willing seller
<b>XII. SUMMARY/COMMENTS</b>						
	ChF do not reach site at present	ChS reach site	At or near limit of upstream distribution	ChS reach site	At or near limit of upstream distribution	ChS reach site

TABLE 26 (2 of 2)

## ADULT CAPTURE SCREENING CRITERIA

CRITERION	Minthorn		Three Mile Dam	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	n/a Acceptable Acceptable None identified None identified	n/a Acceptable Acceptable None identified None identified	n/a Acceptable Acceptable None identified None identified	n/a Acceptable Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline Row 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	35-44 cfs during period Good Existing n/a n/a pump, existing Low	35-44 cfs during period Good Existing n/a n/a pump, existing Low	Flows vary with diversions F b m vary with diversions Existing n/a n/a n/a n/a	Acceptable Acceptable Existing n/a n/a n/a n/a
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	65, on side-channel Typically reach the site N/A	65, on side-channel Typically reach the site Good	3 Typically reach the site N/A	3 Typically reach the site Good
<b>IV. PERIOD OF USE</b>	Sep. - Dec.	Apr. 15 - Jul 15	Sep. - Dec.	Apr. 15 - Jul 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Socio/Aesthetic 23. Accessibility	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway	Minimal rural to urban, ag. Undetermined Negligible Negligible Negligible Adjacent to paved road	Minimal rural to urban, ag. Undetermined Negligible Negligible Negligible Adjacent to paved road
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Limited Limited	Limited Limited Yes	Existing Existing n/a	Existing Existing Yes, existing
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Mostly flat Minimal Undetermined 3-phase at site Exist!! facility Alluvial/some gw potential gravel road off highway	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway	Mostly flat Existing facility Existing facility Existing facility Existing facility Alluvial/low gw potential Adjacent to paved road	Mostly flat Existing facility Existing facility Existing facility Existing facility Alluvial/low gw potential Adjacent to paved road
<b>VIII. PUBLIC EDUCATION/ACCESS</b>	Possible	Possible	Possible	Possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Existing Existing Existing	Existing Existing Existing
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	Existing facility Undetermined Low	Existing facility Undetermined Low	Existing facility Undetermined Low	Existing facility Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private Existing lease	Private Private Existing lease	ODF&W, CTUIR, BR ODF&W, CTUIR, BR Existing facility	ODF&W, CTUIR, BR ODF&W, CTUIR, BR Existing facility
<b>XII. SUMMARY/COMMENTS</b>	not on main channel of river	not on main channel of river		

TABLE 27 (1 of 3)

## ADULT HOLDING SCREENING CRITERIA

	Meacham Creek at Bonifer Springs		Corporation - N. Fork Supply		Corporation - N. & S. Fork Supply	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Low with spring supply Not determined Probably acceptable None identified Adjacent to RR ROW	Low with spring supply Not determined Probably acceptable None identified Adjacent to RR ROW	Some, with river supply Good during period Acceptable None identified None identified	Some, with river supply Good during period Acceptable None identified None identified	Some, with river supply Acceptable, near high limit Acceptable None identified None identified	Some, with river supply Acceptable, near high limit Acceptable None identified None identified
<b>II. LOCATION</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline Row 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	Approx. 2 cfs from Springs Good Poor, bedload movement Good, pass under RR undetermined Pump if use Creek High	Approx. 2 cfs from Springs Good Poor, bedload movement Good, pass under RR undetermined Pump if use Creek High	33+ avg cfs during period Good Good but distant from site 1,500 to 3,000 feet w/ gravity 1,500 to 3,000 feet w/ gravity Gravily or pump High	33+ avg cfs during period Good Good but distant from site 1,500 to 3,000 feet w/ gravity 1,500 to 3,000 feet w/ gravity Gravily or pump High	45+ avg cfs during period Good Good, 1500 ft. upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravily or pump High	45+ avg cfs during period Good Good, 1500 ft. upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravily or pump High
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	2.5 (Meacham Creek) Do not reach site	2.5 (Meacham Creek) Typically reach site	89 Do not currently reach site	89 Spawn above & below site	89 Do not currently reach site	89 Spawn above & below site
<b>IV. PERIOD OF USE</b> 16.	Sept. - Dec	Apr. 15 - Sept 15	Sept. - Dec	Apr. 15 - Sept 15	Sept. - Dec	Apr. 15 - Sept 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Bonifer Springs Coniferous forest, grassland Undetermined Negligible Negligible Negligible gravel road to site	Bonifer Springs Coniferous forest, grassland Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Yes Yes N/A	Yes Yes yes - existing facility	Yes, 5.8 acres available 5.5 acres N/A	Yes, 5.8 acres available 5.8 acres Yes	v44.5.5 acres available 5.5 acres N/A	Yes, 5.8 acres available 5.8 acres
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Public Services 31. Costs of acquiring site 32. Soil/Groundwater 33. Access	Mostly flat Minimal Moderate 3 phase power near site unknown rocky/existing springs gravel road to site	Mostly flat Minimal Moderate 3 phase power near site unknown rocky/existing springs gravel road to site	Relatively flat 4 acres Minimal High lower at site, type unknown unknown, USFS Alluvial/ gw potential low gravel road to site	Relatively flat 4 acres Minimal High Power at site, type unknown unknown, USFS Alluvial/ gw potential low gravel road to site	Relatively flat 4 acres Minimal High Power at site, type unknown unknown, USFS Alluvial/ gw potential low gravel road to site	Relatively flat 4 acres Minimal High Power at site, type unknown unknown, USFS Alluvial/ gw potential low gravel road to site
<b>VI. PUBLIC EDUCATION/ACCESS</b> 34.	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	Existing facility Undetermined Low	Existing facility Undetermined Low	National forest Undetermined Low	National forest Undetermined Low	National forest Undetermined Low	National forest Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private Unknown	Private Private Unknown	U.S. Forest Service U.S. Forest Service Unknown	U.S. Forest Service U.S. Forest Service Unknown	U.S. Forest Service U.S. Forest Service Unknown	U.S. Forest Service U.S. Forest Service Unknown
<b>XII. SUMMARY/COMMENTS</b>	ChF do not reach site	ChS reach site Expansion may require creek water supply	ChF do not reach site	ChS reach site	ChF do not reach site	ChS reach site

TABLE 27 (2 of 3)

## ADULT HOLDING SCREENING CRITERIA

CRITERION	Emmett Williams		Fred Gray-80+ cros		Minnehaha Springs	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Sept. high beyond peak max Acceptable None identified None identified	Some, w/ river supply May-Sept high temps Acceptable None identified None identified	Some, w/ river supply Sept. high beyond peak max Acceptable None identified None identified	Some, w/ river supply May-Sept high temps Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	35+ avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	35+ avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	35+ avg cfs during period Good Good, at upstream boundary Good, bury in pasture Approx. 500 ft. if gravity Either Moderate	35+ avg cfs during period Good Good, at upstream boundary Good, bury in pasture Approx. 500 ft. if gravity Either Moderate	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	81 Near limit of upstream dist. n/a	81 Typically reach site n/a	80 (approx 1/2 flat) Near limit of upstream dist. n/a	80 (approx 1/2 flat) Typically reach site n/a	11 Trucked from Three Mile Dam	11 Trucked from Three Mile Dam
<b>IV. PERIOD OF USE</b>	Sept. - Dec	Apr. 15 - Sept 15	Sept. - Dec	Apr. 15 - Sept 15	Sept. - Dec	Apr. 15 - Sept 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	10 acres 10 acres n/a	10 acres 10 acres n/a	80 acres 80 acres n/a	80 acres 80 acres n/a	Approx. 2+ acres Approx. 2+ acres n/a	Approx. 2+ acres Approx. 2+ acres n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site	Flat Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to site	Flat Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to site	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site
<b>VIII. PUBLIC ACCESS/EDUCATION</b>	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	G-1, CTUIR Undetermined Low	G-1, CTUIR Undetermined Low	G-1, CTUIR Undetermined Low	G-1, CTUIR Undetermined Low	undetermined undetermined Low	undetermined undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private - Emmett Williams Umatilla County ROW Unknown	Private - Emmett Williams Umatilla County ROW Unknown	Private - Fred Gray Private - Fred Gray unknown-willing seller	Private - Fred Gray Private - Fred Gray unknown-willing seller	City of Hermiston City of Hermiston unknown	City of Hermiston City of Hermiston unknown
<b>XII. SUMMARY/COMMENTS</b>	At or near limit of upstream distribution HI Swt. temperatures	May - July temperatures can exceed max. diurnal flux	At or near limit of upstream distribution HI Sept. temperatures	May - July temperatures can exceed max. diurnal flux	Concern w/ domestic water supply, facility discharge	Concern w/ domestic water supply, facility discharge

TABLE 27 (3 of 3)

## ADULT HOLDING SCREENING CRITERIA

CRITERION	Cottonwood Bend		Three Mile Dam	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b>				
1. Disease potential	Low with groundwater	Low with groundwater	n/a	n/a
2. Water temperature	Undetermined, rep. mid-50s	Undetermined, rep. mid-50s	Acceptable	Temp. too high
3. General minerals	Undetermined	Undetermined	Acceptable	Acceptable
4. Other pollutants (phosphate, oil & grease)	None identified	None identified	None identified	None identified
5. Offsite risks	None identified	None identified	None identified	None identified
<b>II. WATER QUANTITY</b>				
6. Availability	reported 2000 gpm	reported 2000 gpm	Acceptable	Acceptable
7. Dependability	Undetermined	Undetermined	Acceptable	Acceptable
8. Intake structure	Undetermined	Undetermined	Existing	Existing
9. Pipeline ROW	undetermined	undetermined	n/a	n/a
10. Bypass reach (length and location)	none	none	n/a	n/a
11. Pumped versus gravity source	pumped	pumped	n/a	n/a
12. Cost of water supply (construction, O&M)	high	high	n/a	n/a
<b>III. LOCATION ON RIVER</b>				
13. River mile	region near RM 11-13	region near RM 11-13	3	3
14. Spawning distribution (natural run)	Pass site if not trucked	Pass site if not trucked	Typically reach the site	Typically reach the site
15. Attraction potential	n/a	n/a	good	good
<b>IV. PERIOD OF USE</b>				
16. PERIOD OF USE	Sept - Dec	Apr 15 - Sept 15	Sept - Dec	Apr. 15 - Sept. 15
<b>V. ENVIRONMENTAL CONCERNS</b>				
17. Wetlands (other than riparian zone)	Undetermined, prob. present	Undetermined, prob. present	Minimal	Minimal
18. Terrestrial wildlife and habitats	Waterfowl area	Waterfowl area	rural to urban, eg.	rural to urban, eg.
19. Threatened/endangered species	Undetermined	Undetermined	Undetermined	Undetermined
20. Water quality impacts of facility	Negligible	Negligible	Negligible	Negligible
21. Community impacts	Negligible	Negligible	Negligible	Negligible
22. Scenic/Aesthetic	Undetermined	Undetermined	Negligible	Negligible
23. Accessibility	Adjacent roads	Adjacent roads	Adjacent to paved road	Adjacent to paved road
<b>VI. SIZE OF PARCEL</b>				
24. Space for raceways/ ponds	Undetermined	Undetermined	Existing	Existing
25. Space for sedimentation ponds	Undetermined	Undetermined	Existing	Existing
26. Space for trapping	n/a	n/a	n/a	n/a
<b>VII. SITEWORK COSTS</b>				
27. Topography	Relatively flat	Relatively flat	Mostly flat	Mostly flat
28. Contouring and diking (flood control)	Undetermined	Undetermined	Existing facility	Existing facility
29. Pipeline and intake structure	Undetermined	Undetermined	Existing facility	Existing facility
30. Utilities	Undetermined	Undetermined	Existing facility	Existing facility
31. Costs of acquiring site	Undetermined	Undetermined	Existing facility	Existing facility
32. Soils/Groundwater	Undetermined	Undetermined	Alluvial/low gw potential	Alluvial/low gw potential
33. Access	Adjacent roads	Adjacent roads	Adjacent to paved road	Adjacent to paved road
<b>VIII. PUBLIC EDUCATION/ACCESS</b>				
34. PUBLIC EDUCATION/ACCESS	possible	possible	possible	possible
<b>IX. SECURITY</b>				
35. Intake structure and water supply	Required	Required	Existing	Existing
36. Pipeline	Required	Required	Existing	Existing
37. Raceways/ponds	Required	Required	Existing	Existing
<b>X. PERMITTING</b>				
38. Land Use	Undetermined	Undetermined	Existing facility	Existing facility
39. Shorelines Designation	Undetermined	Undetermined	Unknown	Unknown
40. Flood hazard	Low	Low	Low	Low
<b>XI. PROPERTY OWNERSHIP</b>				
41. Facility site	Undetermined	Undetermined	BPA	BPA
42. Pipeline ROW and intake structure	Undetermined	Undetermined	BPA	BPA
43. Time to acquire site	Undetermined	Undetermined	Existing facility	Existing facility
<b>XII. SUMMARY/COMMENTS</b>				
	Potential but would require investigations	Potential but would require investigations		Max. temperature too high during May - Jul

TABLE 28 (1 of 3)

## INCUBATION AND FRY REARING SCREENING CRITERIA

	Corporation - N. & S. Fork Supply		Emmett Williams		Fred Gray - 80 acres	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Diliu potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, with river supply Good during period Acceptable Non. identified None identified	Some, with river supply Acceptable during period Acceptable None identified None identified	Some, w/ river supply Oct high at max. desirable Acceptable None identified None identified	Some, w/ river supply Aug-Oct too high Acceptable None identified None identified	Some, w/ river supply Oct high at max. desirable Acceptable None identified None identified	Some, w/ river supply Aug-Oct too high Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline Row 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	42-277 avg cfs during period Good Good, 1500 ft upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravity or pump High	42-241 avg cfs during period Good Good, 1500 ft upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravity or pump High	59-370 avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	48-267 avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	59-370 avg cfs during period Good Good, at upstream boundary Good, bury h pasture Approx. 500 ft. if gravity Either Moderate	48-267 avg cfs during period Good Good, at upstream boundary Good, bury h pasture Approx. 500 ft. if gravity Either Moderate
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	89 Do not currently reach site n/a	89 Spawn above site n/a	81 Near limit of upstream dli. n/a	81 Typically reach site n/a	80 Near limit of upstream dli. n/a	80 Typically reach site n/a
<b>IV. PERIOD OF USE</b>	15 - ar	Aug - Feb	Oct 15 - Mar	Aug - Feb	Oct 15 - Mar	Aug - Feb
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Yes, 5.8 acres available 5.9 acres n/a	Yes, 5.8 acres available 58 acres n/a	10 acres 10 acres n/a	10 acres 10 acres n/a	80 acres (approx. 1/2 flat) 80 acres (approx. 1/2 flat) n/a	80 acres (approx. 1/2 flat) 80 acres (approx. 1/2 flat) n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Relatively flat 4 acres Minimal High Power at site, type unknown unknown Alluvial/ gw potential low gravel road to site	Relatively flat 4 acres Minimal High Power at site, type unknown unknown Alluvial/ gw potential low gravel road to site	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site	Flat Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to site	Flat Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to site
<b>VIII. PUBLIC EDUCATION/ACCESS</b>	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	National forest undetermined Low	National forest undetermined Low	G-1, CTUIR undetermined Low	G-1, CTUIR undetermined Low	G-1, CTUIR undetermined Low	G-1, CTUIR undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	U.S. Forest Service U.S. Forest Service Unknown	U.S. Forest Service U.S. Forest Service unknown	Private - Emmett Williams Umatilla County ROW Unknown	Private - Emmett Williams Umatilla County ROW Unknown	Private - Fred Gray Private - Fred Gray unknown - willing seller	Private - Fred Gray Private - Fred Gray unknown - willing seller
<b>XII. SUMMARY/COMMENTS</b>	May require disinfection	May require disinfection	May require disinfection At or near limit of upstream distribution Hi Oct. temperatures	May require disinfection Aug-Oct temperatures can exceed max. diurnal flux	May require disinfection At or near limit of upstream distribution Hi Oct. temperatures	May require disinfection Aug-Oct temperatures can exceed max. diurnal flux

TABLE 28 (2 of 3)

## INCUBATION AND FRY REARING SCREENING CRITERIA

CRITERION	Thorn Holbw		Minthorn		Minnehaha Spring*	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Oct high at max. desirable Acceptable None identified Nom identified	Some, w/ river supply Aug-Oct too high Acceptable None identified None identified	Some, w/ river supply Oct high at max. desirable Acceptable None identified NOM identified	Some, w/ river supply Aug-Oct too high Acceptable None identified Nom identified	Low, spring water Temp. data needed Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 9. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	59-370 avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate	48-267 avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate	Need flow improvements Good Existing n/a n/a pump, existing Low	Need flow improvements Good Existing n/a n/a pump, existing Low	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	72 Upper limit of spawning dist n/a	72 Lower limit of spawning dist n/a	55, on side-channel Typically reach this site	65, on side-channel Typically spawn above site	11 Trucked from Three Mile Dam n/a	11 Trucked from Three Mile Dam n/a
<b>IV. PERIOD OF USE</b>	Oct 15 - Mar	Aug - Feb	Oct 15 - Mar	Aug - Feb	Oct 15 - Mar	Aug - Feb
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 19. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts at facility 21. Community impacts 22. Socio/Aesthetic 23. Accessibility	Minimal Pastures with trees Undetermined Negligible Negligible Negligible paved, dirt to site	Minimal Pastures with trees Undetermined Negligible Negligible Negligible paved, dirt to site	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible gravel road off highway	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible gravel road off highway	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	10+ acres 10+ acres n/a	10+ acres 10+ acres n/a	Limited Limited n/a	Limited Limited n/a	Approx. 2+ acres Approx. 2+ acres n/a	Approx. 2+ acres Approx. 2+ acres n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 29. Contouring and diking (Road control) 29. Pipeline and Intake structure 30. Public Services 31. costs of acquiring site 32. Soils/Groundwater 33. Access	Flat Moderate Moderate 3 phase 1/8 mile away unknown Alluvial/some gw potential paved, dirt to site possible	Flat Moderate Moderate 3 phase 1/8 mile away unknown Alluvial/some gw potential paved, dirt to site possible	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway possible	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway possible	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site possible	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site possible
<b>VIII. PUBLIC EDUCATION/ACCESS</b>						
<b>IX. SECURITY</b> 35. Intake structure and water supply 39. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 39. Land Use 39. Shorelines Designation 40. Flood hazard	Not determined undetermined Low	Not determined undetermined Low	Existing facility undetermined Low	Existing facility undetermined Low	undetermined undetermined Low	undetermined undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private unknown	Private Private unknown	Private Private Existing lease	Private Private Existing lease	City of Hermiston City of Hermiston unknown	City of Hermiston City of Hermiston unknown
<b>XII. SUMMARY/COMMENTS</b>	May require disinfection At or near limit of upstream distribution Hi Oct. temperatures	May require disinfection Hi Aug-Oct temperatures At or near limit of downstream distribution	May require disinfection not on main channel of river Hi Oct temps.	May require disinfection At or near limit of downstream distribution	Concern w/ domestic water supply, facility discharge	Concern w/ domestic water supply, facility discharge



TABLE 28 (3 of 3)

## INCUBATION AND FRY REARING SCREENING CRITERIA

Cottonwood Bond		
CRITERION	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Low with groundwater Undetermined, rep. mid-50 Undetermined None identified None identified	Low with groundwater Undetermined, rep. mid-50 Undetermined None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	reported 2000 gpm Undetermined Undetermined undetermined none pumped high	reported 2000 gpm Undetermined Undetermined undetermined none pumped high
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	region near RM 11-13 Pass site if not trucked n/a	region near RM 11-13 Pass site if not trucked n/a
<b>IV. 16. PERIOD OF USE</b>	Oct 15 - Mar	Aug - Feb
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Undetermined Undetermined n/a	Undetermined Undetermined n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and Intake structure 30. Public Services 31. costs of acquiring site 32. Soils/Groundwater 33. Access	Relatively flat Undetermined Undetermined Undetermined Undetermined Undetermined Adjacent roads	Relatively flat Undetermined Undetermined Undetermined Undetermined Undetermined Adjacent roads
<b>VIII. 34. PUBLIC EDUCATION/ACCESS</b>	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	Undetermined Undetermined Low	Undetermined Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility sit. 42. Pipeline Row and Intake structure 43. Time to acquire site	Undetermined Undetermined Undetermined	Undetermined Undetermined Undetermined
<b>XII. SUMMARY/COMMENTS</b>	Potential but would require investigations	Potential but would require investigations

TABLE 29 (1 of 2)

## SATELLITE REARING SCREENING CRITERIA

CRITERION	Corporation - N. & S. Fork Supply		Emmett Williams		Minthorn	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Good during period Acceptable None identified None identified	Some, w/ river supply Good during period Acceptable None identified None identified	Some, w/ river supply Need temp. data Acceptable None identified None identified	Some, w/ river supply Need temp. data Acceptable None identified None identified	Some, w/ river supply Need temp. data Acceptable None identified None identified	Some, w/ river supply Need temp. data Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	241-451 avg cfs during period Good Good, 1500 ft. upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravity or pump High	212-451 avg cfs during period Good Good, 1500 ft. upstream 1500 ft w/ gravity 1500 ft w/ gravity Gravity or pump High	267/450 avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. ft gravity Either High	318/450 avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. ft gravity Either High	Need flow improvements Good Existing n/a n/a pump, existing Low	Need flow improvements Good Existing n/a n/a pump, existing Low
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	89 Do not currently reach site n/a	89 Spawn above site n/a	81 Near limit of upstream dist. n/a	81 Typically reach site n/a	85, on side-channel Typically reach the site n/a	85, on side-channel Typically spawn above site n/a
<b>IV. 16. PERIOD OF USE</b>	Jan - May 15	Feb - May 15	Jan - May 15	Feb - May 15	Jan - May 15	Feb - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Forested steep slope Undetermined Negligible Negligible Negligible gravel road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible paved road to site	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Yes, 5.8 acres available 5.8 acres n/a	Yes, 5.8 acres available 5.8 acres n/a	10 acres 10 acres n/a	10 acres 10 acres n/a	Limited Limited n/a	Limited Limited n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Public Services 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Relatively flat 4 acres Minimal High Power at site, type unknown unknown Alluvial/ gw potential low gravel road to site possible	Relatively flat 4 acres Minimal High Power at site, type unknown unknown Alluvial/ gw potential low gravel road to site possible	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site possible	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site possible	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway possible	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway possible
<b>VIII. 34. PUBLIC EDUCATION/ACCESS</b>						
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	National forest Undetermined Low	National forest Undetermined Low	G-1, CTUIR Undetermined Low	G-1, CTUIR Undetermined Low	Existing facility Undetermined Low	Existing facility Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and Intake structure 43. Time to acquire site	U.S. Forest Service U.S. Forest Service Unknown	U.S. Forest Service U.S. Forest Service Unknown	Private - Emmett Williams Umatilla County ROW Unknown	Private - Emmett Williams Umatilla County ROW Unknown	Private Private Existing lease	Private Private Existing lease
<b>XII. SUMMARY/COMMENTS</b>	May require disinfection	May require disinfection	May require disinfection At or near limit of upstream distribution	May require disinfection	May require disinfection not on main channel of river	May require disinfection not on main channel of river

TABLE 29 (2 of 2)

## SATELLITE REARING SCREENING CRITERIA

CRITERION	Minnehaha Springs		Cottonwood Bond		Meecham Creek at Boniffr Springs	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Low, spring water Temp. data needed Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable None identified None identified	Low with groundwater Undetermined, rep. mid-50s Undetermined None identified None identified	Low with groundwater Undetermined, rep. mid-50s Undetermined None identified None identified	Low with spring supply Not determined Probably acceptable None identified Adjacent to RR ROW	Low with spring supply Not determined Probably acceptable None identified Adjacent to RR ROW
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	reported 2000 gpm Undetermined Undetermined undetermined none pumped high	reported 2000 gpm Undetermined Undetermined undetermined none pumped high	Approx. 2 cfs from Springs Good Poor, bedload movement Good, pass under RR undetermined Pump if use Creek High	Approx. 2 cfs from Springs Good Poor, bedload movement Good, pass under RR undetermined Pump if use Creek High
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	11 Trucked from Three Mile Dam n/a	11 Trucked from Three Mile Dam n/a	region near RM 11-13 Pass site if not trucked n/a	region near RM 11-13 Pass site if not trucked n/a	2.5 (Meecham Creek) Do not reach site n/a	2.5 (Meecham Creek) Typically reach site n/a
<b>IV. PERIOD OF USE</b>	Jan - May 15	Feb - May 15	Jan - May 15	Feb - May 15	Jan - May 15	Feb - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Sonic/Aesthetic 23. Accessibility	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads	Boniffr Springs Coniferous forest, grassland Undetermined Negligible Negligible Negligible gravel road to site	Boniffr Springs Coniferous forest, grassland Undetermined Negligible Negligible Negligible gravel road to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	Approx. 2+ acres Approx. 2+ acres n/a	Approx. 2+ acres Approx. 2+ acres n/a	Undetermined Undetermined n/a	Undetermined Undetermined n/a	Yes Yes n/a	Yes Yes yes - existing facility
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site possible	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site possible	Relatively flat Undetermined Undetermined Undetermined Undetermined Adjacent roads possible	Relatively flat Undetermined Undetermined Undetermined Undetermined Adjacent roads possible	Mostly flat Minimal Moderate 3 phase power to site unknown rocky/existing springs gravel road to site possible	Mostly flat Minimal Moderate 3 phase power to site unknown rocky/existing springs gravel road to site possible
<b>VIII. PUBLIC EDUCATION/ACCESS</b>						
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	undetermined undetermined Low	undetermined undetermined Low	Undetermined Undetermined Low	Undetermined Undetermined Low	Existing facility Undetermined Low	Existing facility Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	City of Hermiston City of Hermiston unknown	City of Hermiston City of Hermiston unknown	Undetermined Undetermined Undetermined	Undetermined Undetermined Undetermined	Private Private Unknown	Private Private Unknown
<b>XII. SUMMARY/COMMENTS</b>	Concern w/ domestic water supply, facility discharge	Concern w/ domestic water supply, facility discharge	Potential but would require investigations	Potential but would require investigations	ChF do not reach site	ChS reach site Expansion may require creek water supply

TABLE 30 (1 of 5)

## EXTENDED REARING/ACCLIMATION SCREENING CRITERIA

	Meacham Creek a Cmp Creek		Meacham Creek at Bonifer Springs		Corporation - N. & S. Fork Supply	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b>						
1. Disease potential	Potential w/ river supply	Potential w/ river supply	Low with spring supply	Low with spring supply	Some, with river supply	Some, with river supply
2. Water temperature	Probably ok	Probably ok	Probably ok	Probably ok	Good during period	Good during period
3. General minerals	Undetermined	Undetermined	Probably acceptable	Probably acceptable	Acceptable	Acceptable
4. Other pollutants (phosphate, Oil & grease)	None identified	None identified	None identified	None identified	None identified	None identified
5. Offsite risks	Adjacent to RR ROW	Adjacent to RR ROW	Adjacent to RR ROW	Adjacent to RR ROW	None identified	None identified
<b>II. WATER QUANTITY</b>						
6. Availability	Flow data required	flow data required	Approx. 2 cfs from Springs	Approx. 2 cfs from Springs	400+ avg cfs during period	250+ avg cfs during period
7. Dependability	Flow data required	Flow data required	Good	Good	Good	Good
8. Intake structure	Unstable, poor grade control	Unstable, poor grade control	Creek bedload movement	Creek bedload movement	Good, 1500 ft. upstream	Good, 1500 ft. upstream
9. Pipeline ROW	Under RR ROW	Under RR Row	Good, pass under RR	Good, pass under RR	1500 ft w/ gravity	1500 ft w/ gravity
10. Bypass reach (length and location)	Approx. 400+ ft.	Approx. 400+ ft.	undetermined	undetermined	1500 ft w/ gravity	1500 ft w/ gravity
11. Pumped versus gravity source	Pump from stable pool	Pump from stable pool	Pump if use Creek	Pump if use Creek	Gravity or pump	Gravity or pump
12. Cost of water supply (construction, O&M)	High	High	High	High	High	High
<b>III. LOCATION ON RIVER</b>						
13. River mile	11 (Meacham Creek)	11 (Meacham Creek)	2.5 (Meacham Creek)	2.5 (Meacham Creek)	89	89
14. Spawning distribution (natural run)	Do not reach this site	Few spawn at and above site	Do not reach site	Spawn at and above site	Do not currently reach site	Spawn below and above site
15. Attraction potential	n/a	n/a	n/a	n/a	n/a	n/a
<b>IV. PERIOD OF USE</b>						
16. PERIOD OF USE	Apr - May 15	- 1	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15
<b>V. ENVIRONMENTAL CONCERNS</b>						
17. Wetlands (other than riparian zone)	Minimal	Minimal	Bonifer Springs	Bonifer Springs	Minimal	Minimal
18. Terrestrial wildlife and habitats	Conif. forest/grassland	Conif. forest/grassland	Coniferous forest, grassland	Coniferous forest, grassland	Forested steep slope	Forested steep slope
19. Threatened/endangered species	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
20. Water quality impacts of facility	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
21. Community impacts	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
22. Socio/Aesthetic	Minor	Minor	Negligible	Negligible	Negligible	Negligible
23. Accessibility	11 mile gravel road	11 mile gravel road	gravel road to site	gravel road to site	gravel road to site	gravel road to site
<b>VI. SIZE OF PARCEL</b>						
24. Space for raceways/ ponds	4 acres	4 acres	Yes	Yes	Yes, 5.8 acres available	Yes, 5.8 acres available
25. Space for sedimentation ponds	4 acres	4 acres	Yes	Yes	5.8 acres	5.8 acres
26. Space for trapping	n/a	n/a	n/a	n/a	n/a	n/a
<b>VII. SITEWORK COSTS</b>						
27. Topography	Flat	Flat	Mostly flat	Mostly flat	Relatively flat 4 acres	Relatively flat 4 acres
29. Contouring and diking (flood control)	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal
29. Pipeline and intake structure	High	High	Moderate	Moderate	High	High
30. Utilities	No nearby power	No nearby power	3-phase power near site	3-phase power near site	Power at site, type unknown	Power at Sk. type unknown
31. costs of acquiring site	unknown	unknown	unknown	unknown	unknown	unknown
32. Soils/Groundwater	Alluvial/gw potential low	Alluvial/gw potential low	rocky/existing springs	rocky/existing springs	Alluvial/ gw potential low	Alluvial/ gw potential low
33. Access	11 mile gravel road	11 mile gravel road	gravel road to site	gravel road to site	gravel road to site	gravel road to site
<b>VIII. PUBLIC EDUCATION/ACCESS</b>	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b>						
35. Intake structure and water supply	Required	Required	Required	Required	Required	Required
36. Pipeline	Required	Required	Required	Required	Required	Required
37. Raceways/ponds	Required	Required	Required	Required	Required	Required
<b>X. PERMITTING</b>						
38. Land Use	unknown	unknown	Existing facility	Existing facility	National forest	National forest
39. Shorelines Designation	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
40. Flood hazard	Low	Low	Low	Low	Low	Low
<b>XI. PROPERTY OWNERSHIP</b>						
41. Facility site	Private	Private	Private	Private	U.S. Forest Service	U.S. Forest Service
42. Pipeline ROW and Intake structure	Private	Private	Private	Private	U.S. Forest Service	U.S. Forest Service
43. Time to acquire site	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
<b>XII. SUMMARY/COMMENTS</b>						
	May need disinfect w. creek	May need disinfect w. creek	May need disinfect w. creek	May need disinfect w. creek	May require disinfection	May require disinfection
	Structural integrity of bridges may be of concern	Structural integrity of bridges may be of concern	ChF do not reach site	ChS reach site		
				Expansion may require creek water supply		

TABLE 30 (2 of 5)

## EXTENDED REARING/ACCLIMATION SCREENING CRITERIA

CRITERION	Emmett Williams		Fred Gray - 80 acres		Thorn Hollow	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable No <sup>1</sup> identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	450+ avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	370+ avg cfs during period Good Good, 500 ft. upriver Good, bury in road Approx. 500 ft. if gravity Either High	450+ avg cfs during period Good Good, at upstream boundary Good, bury in pasture Approx. 500 ft. if gravity Either Moderate	370+ avg cfs during period Good Good, at upstream boundary Good, bury in pasture Approx. 500 ft. if gravity Either Moderate	450+ avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate	370+ avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	81 Near limit of upstream dist. n/a	81 Spawn above and below site n/a	80 Near limit of upstream dbt n/a	80 Spawn above and below site n/a	72 Nr. upper limit of spawning dist n/a	72 Nr. lower limit of spawning dist n/a
<b>IV. PERIOD OF USE</b> 16.	Apr - May 15	- 1	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Scenic/Aesthetic 23. Accessibility	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible Negligible paved road to site	Minimal Mixed forest, cleared land Undetermined Negligible Negligible Negligible Negligible paved road to site	Minimal Pastures with trees Undetermined Negligible Negligible Negligible Negligible paved, dirt to site	Minimal Pastures with trees Undetermined Negligible Negligible Negligible Negligible paved, dirt to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	10 acres 10 acres	10 acres 10 acres	80 acres (approx. 1/2 flat) 80 acres (approx. 1/2 flat)	80 acres (approx. 1/2 flat) 80 acres (approx. 1/2 flat)	10+ acres 10+ acres	10+ acres 10+ acres n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 29. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. costs of acquiring site 32. Soils/Groundwater 33. Access	Flat, steep bank at river Minimal High 3 phase par to site unknown Alluvial/good gw potential Paved road to site	Flat, steep bank at river Minimal High 3 phase power to site unknown Alluvial/good gw potential Paved road to site	Flat Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to sit.	FM Moderate Moderate 3 phase power to site unknown Alluvial/some gw potential Paved road to site	Flat Moderate Moderate 3 phase 1/8 mile away unknown A m - gw potential paved, dirt to site	Flat Moderate Moderate 3 phase 1/8 mile away unknown Alluvial/some gw potential paved, dirt to sit.
<b>VIII. PUBLIC EDUCATION/ACCESS</b> 34.	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	G-1. CTUIR Undetermined Low	G-1. CTUIR Undetermined Low	G-1. CTUIR Undetermined Low	G-1. CTUIR Undetermined Low	CTUIR Undetermined Low	CTUIR Undetermined
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private - Emmett Williams Umatilla County ROW Unknown-willing seller	Private - Emmett Williams Umatilla County ROW Unknown-willing seller	Private - Fred Gray Private - Fred Gray unknown-willing seller	Private - Fred Gray Private - Fred Gray unknown-willing seller	Private Private unknown	Private Private unknown
<b>XII. SUMMARY/COMMENTS</b>	At or near limit of upstream distribution		At or near limit of upstream distribution		At or near limit of upstream distribution	

TABLE 30 (3 of 5)

## EXTENDED REARING/ACCLIMATION SCREENING CRITERIA

	Cayuse Bridge		Minthorn		Mission	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified	Some, w/ river supply Probably ok, need temp data Acceptable None Identified None Identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline Row 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	450+ avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate	370+ avg cfs during period Good Good, for pumped supply Good Minimal Pumped Moderate	Need flow improvements Good Existing n/a n/a pump, existing Low	Need flow improvements Good Existing n/a n/a pump, existing Low	450+ avg cfs during period Good Pump, 10+ feet above river on site Minor Pumped High	370+ avg cfs during period Good Pump, 10+ feet above river on site Minor Pumped High
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	67.5 Ir. upper limit spawning dist n/a	67.5 Nr. lower limit spawning dist n/a	65, on side-channel Typically reach the site n/a	65, on side-channel Typically spawn above site n/a	61 Typically reach the site n/a	61 Typically spawn above site n/a
<b>iv. 15. PERIOD OF USE</b>	Apr - May 15	Apr - May 15	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Socio/Aesthetic 23. Accessibility	Minimal Pastures with trees Undetermined Negligible Minor-Moderate Minor-Moderate paved, dirt to site	Minimal Pastures with trees Undetermined Negligible Minor-Moderate Minor-Moderate paved, dirt to site	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway	Beaver ponds at site Wooded, riparian area Undetermined Negligible Negligible Negligible gravel road off highway	Minimal Residential, fields Undetermined Negligible Minor to moderate Minor to moderate 150 ft. off paved road	Minimal Residential, fields Undetermined Negligible Minor to moderate Minor to moderate 150 ft. off paved road
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	2-3 acres 2-3 acres n/a	2-3 acres 2-3 acres n/a	Limited Limited n/a	Limited Limited n/a	Limited, approx. 0.75 acres Limited n/a	Limited, approx. 0.75 acres Limited n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Flat Moderate Moderate 3 phase unknown Alluvial/some gw potential paved, dirt to site	Flat Moderate Moderate 3 phase unknown Alluvial/some gw potential paved, dirt to site	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway	Mostly flat Minimal Undetermined 3-phase at site Existing facility Alluvial/some gw potential gravel road off highway	Mostly flat Minimal High 3-phase at site Unknown Gravels/low gw potential 150 ft. off paved road	Mostly flat Minimal High 3-phase at site Unknown Gravels/low gw potential 150 ft. off paved road
<b>VIII. 34. PUBLIC EDUCATION/ACCESS</b>	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 36. Land Use 39. Shorelines Designation 40. Flood hazard	Not determined Undetermined Low	Not determined Undetermined Low	Existing facility Undetermined Low	Existing facility Undetermined Low	Residential Undetermined Low	Residential Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private unknown	Private Private unknown	Private Private Existing lease	Private Private Existing lease	Private Private Unknown	Private Private Unknown
<b>XII. SUMMARY/COMMENTS</b>	At or near limit of upstream distribution May require disinfection	At or near limit of downstream distribution May require disinfection	not on main channel of river May require disinfection	not on main channel of river May require disinfection	Limited space May require disinfection	Limited space May require disinfection

TABLE 30 (4 of 5)

## EXTENDED REARING/ACCLIMATION SCREENING CRITERIA

CRITERION	ODF&W		Barnhart		Nolin	
	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Probably ok, need temp data Acceptable None identified None identified	Some, w/ river supply Acceptable Acceptable None identified None identified	Some, w/ river supply Acceptable Acceptable None identified None identified	Some, w/ river supply Acceptable Acceptable None identified None identified	Some, w/ river supply Acceptable Acceptable None identified None identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline Row 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	450+ avg cfs during period Good Good, at upstream end Good, on site 300+ feet Gravity Moderate	450+ avg cfs during period Good Good, at upstream end Good, on site 300+ feet Gravity Moderate	800+ avg cfs during period Good Good, at upstream end Good, on site Minimal Pumped High	800+ avg cfs during period Good Good, at upstream end Good, on site Minimal Pumped High	800+ avg cfs during period Good None required Good, pumped Minimal Pumped High	800+ avg cfs during period Good None required Good, pumped Minimal Pumped High
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	56.2 Spawn below and above site n/a	56.2 Spawn above site n/a	43.25 Spawn near and above site n/a	43.25 Below spawning habitat n/a	35 Spawn near and above site n/a	35 Below spawning habitat n/a
<b>IV. PERIOD OF USE</b> 16.	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. War quality impacts of facility 21. Community impacts 22. Socio/Aesthetic 23. Accessibility	Small riparian wetlands Deciduous trees, grasses Undetermined Negligible Minor-Moderate Minor-Moderate paved, dirt to site	Small riparian wetlands Deciduous trees, grasses Undetermined Negligible Minor-Moderate Minor-Moderate paved, dirt to site	Minimal Deciduous trees, grassland Undetermined Negligible Negligible Negligible paved, dirt to site	Minimal Deciduous trees, grassland Undetermined Negligible Negligible Negligible paved, dirt to site	Minimal Pasture, ag. Undetermined Negligible Negligible Negligible paved, gravel to site	Minimal Pasture, ag. Undetermined Negligible Negligible Negligible paved, gravel to site
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	5+ acres 5+ acres n/a	5+ acres 5+ acres n/a	10 acres 10 acres n/a	10 acres 10 acres n/a	Undetermined, large yes n/a	Undetermined, large yes
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Utilities 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Flat Minimal Moderate 3 phase unknown Alluvial/low gw potential paved, dirt to site	Flat Minimal Moderate 3 phase unknown Alluvial/low gw potential paved, dirt to site	Flat Minimal High 3 phase at site unknown Alluvial/low gw potential paved, dirt to site	Flat Minimal High 3 phase at site unknown Alluvial/low gw potential paved, dirt to site	Flat Minimal Moderate, no intake 3 phase at site unknown Alluvial/low gw potential paved, gravel to site	Flat Minimal Moderate, no intake 3 phase at site unknown Alluvial/low gw potential paved, gravel to site
<b>VIII. PUBLIC EDUCATION/ACCESS</b> 34.	possible	possible	possible	possible	possible	possible
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	Not determined Undetermined Low	Not determined Undetermined Low	Not determined Undetermined Low	Not determined Undetermined Low	Not determined Undetermined Low	Not determined Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private, on site ODF&W may acquire	Private Private, on site ODF&W may acquire	Private Private, on site Undetermined	Private Private, on site Undetermined	Private Private, on site Undetermined	Private Private, on site Undetermined
<b>XII. SUMMARY/COMMENTS</b>	May require disinfection	Below limit of downstream spawning May require disinfection	May require disinfection	Below limit of downstream spawning May require disinfection	May require disinfection	Below limit of downstream spawning May require disinfection

TABLE 30 (5 of 5)

## EXTENDED REARING/ACCLIMATION SCREENING CRITERIA

	Echo Meadows		Minnehaha Springs		Cottonwood Bend	
CRITERION	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook	Fall Chinook	Spring Chinook
<b>I. WATER QUALITY</b> 1. Disease potential 2. Water temperature 3. General minerals 4. Other pollutants (phosphate, oil & grease) 5. Offsite risks	Some, w/ river supply Acceptable Acceptable None identified None identified	Some, w/ river supply Acceptable Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable None identified None identified	Low, spring water Temp. data needed Acceptable m m identified m m identified	Low with groundwater Undetermined, rep. mid-508 Undetermined None identified None identified	La with groundwater Undetermined, rep. mid-50s Undetermined m m identified m m identified
<b>II. WATER QUANTITY</b> 6. Availability 7. Dependability 8. Intake structure 9. Pipeline ROW 10. Bypass reach (length and location) 11. Pumped versus gravity source 12. Cost of water supply (construction, O&M)	800+ avg cfs during period Good, w/ water rights Divert from exist. structure on-site, 1,000+ ft. Minimal Gravity High	800+ avg cfs during period Good, w/ water rights Divert from exist. structure on-site, 1,000+ ft. Minimal Gravity High	8 - 11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	8-11 cfs during period Reported as consistent undetermined undetermined undetermined Pumped Moderate	reported 2000 gpm Undetermined Undetermined undetermined none pumped high	reported 2000 gpm Undetermined Undetermined undetermined none pumped high
<b>III. LOCATION ON RIVER</b> 13. River mile 14. Spawning distribution (natural run) 15. Attraction potential	24.2 Spawn near and above site n/a	24.2 Below spawning habitat n/a	11 Trucked from Three Mile Dam n/a	11 Trucked from Three Mile Dam n/a	region near RM 11-13 Pass site if not trucked n/a	region near RM 11-13 Pass site if not trucked n/a
<b>IV. 16. PERIOD OF USE</b>	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15	Apr - May 15	Mar - May 15
<b>V. ENVIRONMENTAL CONCERNS</b> 17. Wetlands (other than riparian zone) 18. Terrestrial wildlife and habitats 19. Threatened/endangered species 20. Water quality impacts of facility 21. Community impacts 22. Sonar/Aesthetic 23. Accessibility	Minimal Decid. trees, bare ground Undetermined Negligible Negligible Negligible paved, gravel to site	Minimal Decid. trees, bare ground Undetermined Negligible Negligible Negligible paved, gravel to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Entire springs area Sagebrush and tall grasses Undetermined Domestic water supply Near private homes Moderate road to site	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads	Undetermined, prob. present Waterfowl area Undetermined Negligible Negligible Undetermined Adjacent roads
<b>VI. SIZE OF PARCEL</b> 24. Space for raceways/ ponds 25. Space for sedimentation ponds 26. Space for trapping	8 acres yes n/a	8 acres yes n/a	Approx. 2+ acres Approx. 2+ acres n/a	Approx. 2+ acres Approx. 2+ acres	Undetermined Undetermined n/a	Undetermined Undetermined n/a
<b>VII. SITEWORK COSTS</b> 27. Topography 28. Contouring and diking (flood control) 29. Pipeline and intake structure 30. Public services 31. Costs of acquiring site 32. Soils/Groundwater 33. Access	Flat Minimal Moderate, exist. intake 3 phase at site unknown Alluvial/low gw potential paved, gravel to site possible	Flat Minimal Moderate, exist. intake 3 phase at site unknown Alluvial/low gw potential paved, gravel to site possible	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown Sand-silt/good groundwater road to site possible	Flat, steep bank at spring Minimal Moderate 3 phase power to site unknown and-silt/good groundwater road to site possible	Relatively flat Undetermined Undetermined Undetermined Undetermined Adjacent roads possible	Relatively flat Undetermined Undetermined Undetermined Undetermined Adjacent roads possible
<b>VIII. 34. PUBLIC EDUCATION/ACCESS</b>						
<b>IX. SECURITY</b> 35. Intake structure and water supply 36. Pipeline 37. Raceways/ponds	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required	Required Required Required
<b>X. PERMITTING</b> 38. Land Use 39. Shorelines Designation 40. Flood hazard	Not determined Undetermined Low	Not determined Undetermined Low	undetermined Undetermined Low	undetermined Undetermined Low	Undetermined Undetermined Low	Undetermined Undetermined Low
<b>XI. PROPERTY OWNERSHIP</b> 41. Facility site 42. Pipeline ROW and intake structure 43. Time to acquire site	Private Private, on site Undetermined	Private Private, on site Undetermined	City of Hermiston City of Hermiston unknown	City of Hermiston City of Hermiston unknown	Undetermined Undetermined Undetermined	Undetermined Undetermined Undetermined
<b>XII. SUMMARY/COMMENTS</b>	Availability d water right May require disinfection	Availability of water right Below limit of downstream spawning May require disinfection	Concern w/ domestic water supply, facility discharge Upstream diversions	Concern w/ domestic water supply, facility discharge Upstream diversions	Potential but would require investigations	Potential but would require investigations



## PROGRAM DEVELOPMENT

One objective in identifying programs was to provide options that contained flexibility. Flexibility could be provided by choosing sites that can accommodate more than one type of facility. For example:

- **Adult Capture** - Capture of **ChF** would occur at the existing Three Mile Dam facility under all options. Capture of **ChS** could also occur at **Three** Mile Dam and, in the future, at an upstream site. The Emmett Williams and Fred Gray sites appeared to offer the most flexibility in this regard.

**Adult Holding, Rearing, and Satellite Rearing** - It is most efficient to select sites for these facilities that can accommodate all or most of the functions. This gives maximum flexibility for future planning.

**Direct Release, Extended Rearing/Acclimation** - Many direct release sites are available in the basin, and a number of these are already in use. For planning purposes, we have assumed that direct release sites considered in conceptual design should also be able to accommodate Extended Rearing/Acclimation functions.

Table 31 presents the proposed program for the Umatilla River that will be used during the conceptual design phase of the project. It should be pointed out that although one program, maximizing the use of one site (Emmett Williams), is identified, this does not preclude development of one or more of the facilities at another site. Other sites, such as Corporation, Fred Gray 80 acres, and (depending on the outcome of the NEOH program site analysis) out of basin sites have the potential to allow development of one or more of the facility types.

Emmett Williams was identified as the site having the most favorable characteristics for adult holding and satellite rearing and, depending on the outcome of planned groundwater investigations, incubation and rearing. The potential to acquire this site also appears to be very favorable.

**TABLE 31**  
**PROPOSED UMATILLA BASIN PROGRAM**

<b>Adult Capture:</b> ChF and ChS - Three Mile Dam	
<b>Adult Holding Alternatives:</b> (listed from upstream to downstream for ChS)	
ChF	Three Mile Dam
ChS/ChF	Corporation
	Emmett Williams
	Fred Gray
	Russell Walker (S. Fork Walla Walla)
<b>Incubation Alternatives:</b>	
ChF	Umatilla Hatchery
ChS	corporation
	Emmett Williams
	Fred Gray
	Russell Walker (S. Fork Walla Walla)
<b>Early Rearing Alternatives:</b>	
ChF	Umatilla Hatchery
ChS	Corporation
	Emmett Williams
	Fred Gray
	Russell Walker (S. Fork Walla Walla)
<b>Full term (Satellite) Rearing Alternatives:</b>	
ChF	not applicable
ChS	Corporation
	Emmett Williams
	Fred Gray
	Russell Walker (S. Fork Walla Walla)
<b>Final (Extended)Rearing/Acclimation and/or Direct Release Site Alternatives (b):</b>	
ChF	1. Echo Meadows (c,d)
	2. Nolin (c,d)
	3. Barnhart (c,d)
	4. ODF&W (d,e)
	5. Mission (d,e)
	6. Cayuse Bridge (d,e)
ChF/ChS	7. Thorn Hollow (d,e,f,g)
ChS	8. Fred Gray (f,g)
	9. Corporation (f,g)
	10. Mcacham Creek at Camp Creek (f)

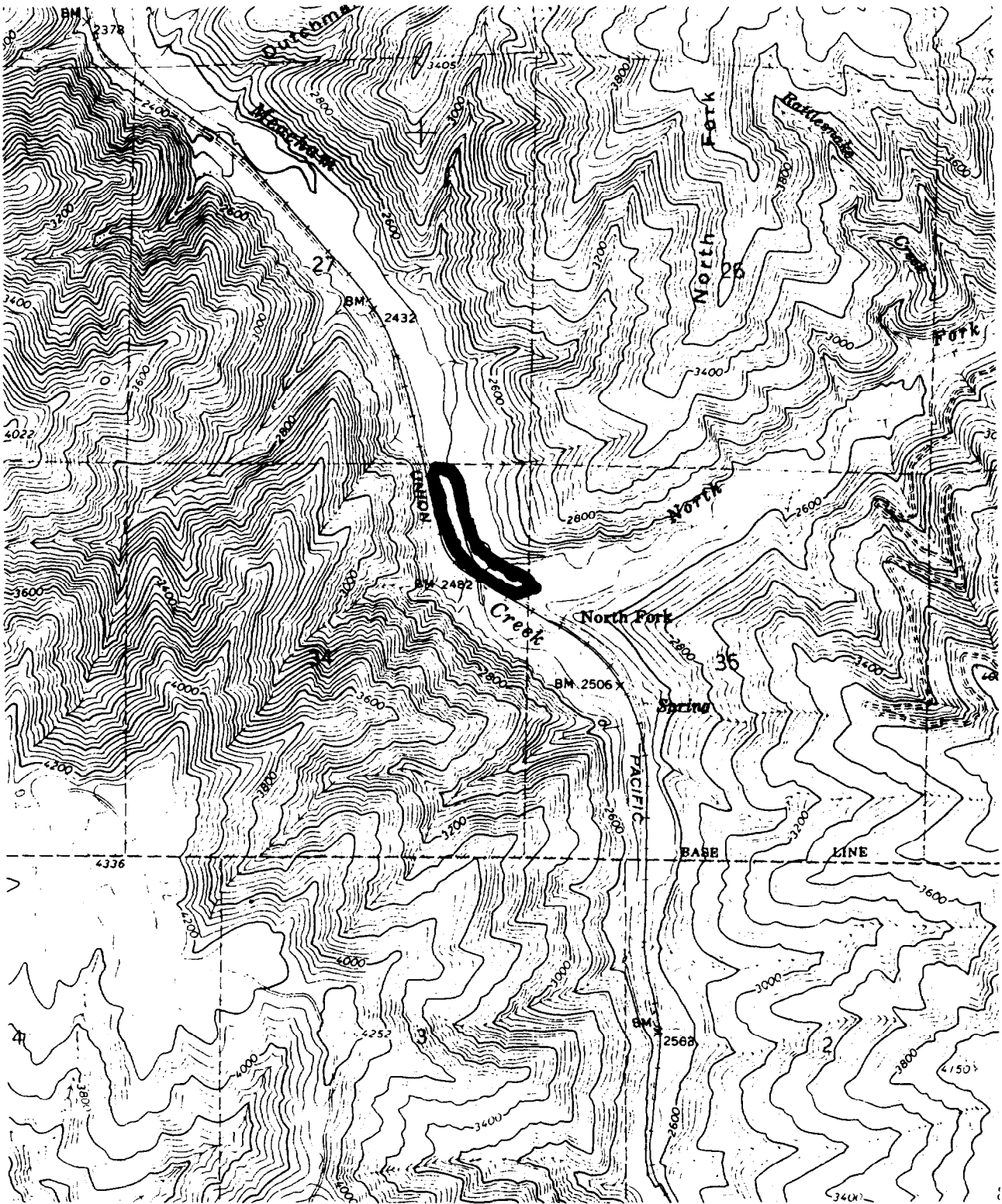
**Notes:**

- (a) In-basin rearing for Phase 2 planning purposes. Dependent on NEOH siting.
- (b) These sites selected on the basis of accommodating both functions, giving more flexibility to the program.
- (c) Short term: Direct release of 1.44 million ChF, non-evaluation fish
- (d) Long term: Direct release with extended rearing/acclimation
- (e) Short term: Direct release 3.24 million ChF, O<sub>2</sub> versus standard
- (f) Short term: Non-evaluation ChS
- (g) Short term: Direct release 1.44 million ChS, O<sub>2</sub> versus standard

## LITERATURE CITED

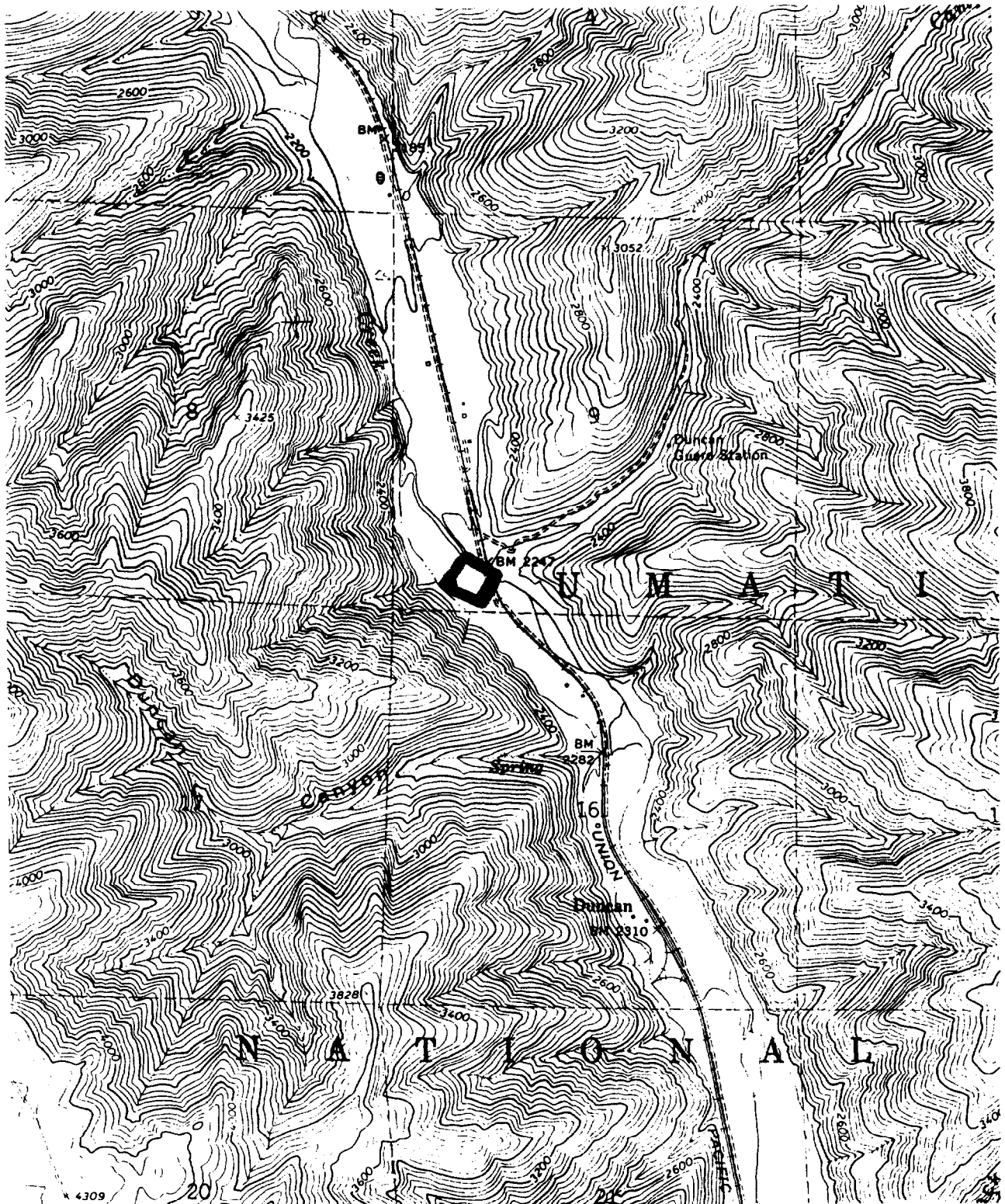
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**APPENDIX A**  
**SITE DATA SHEETS**



**North Fork Meacham Creek**

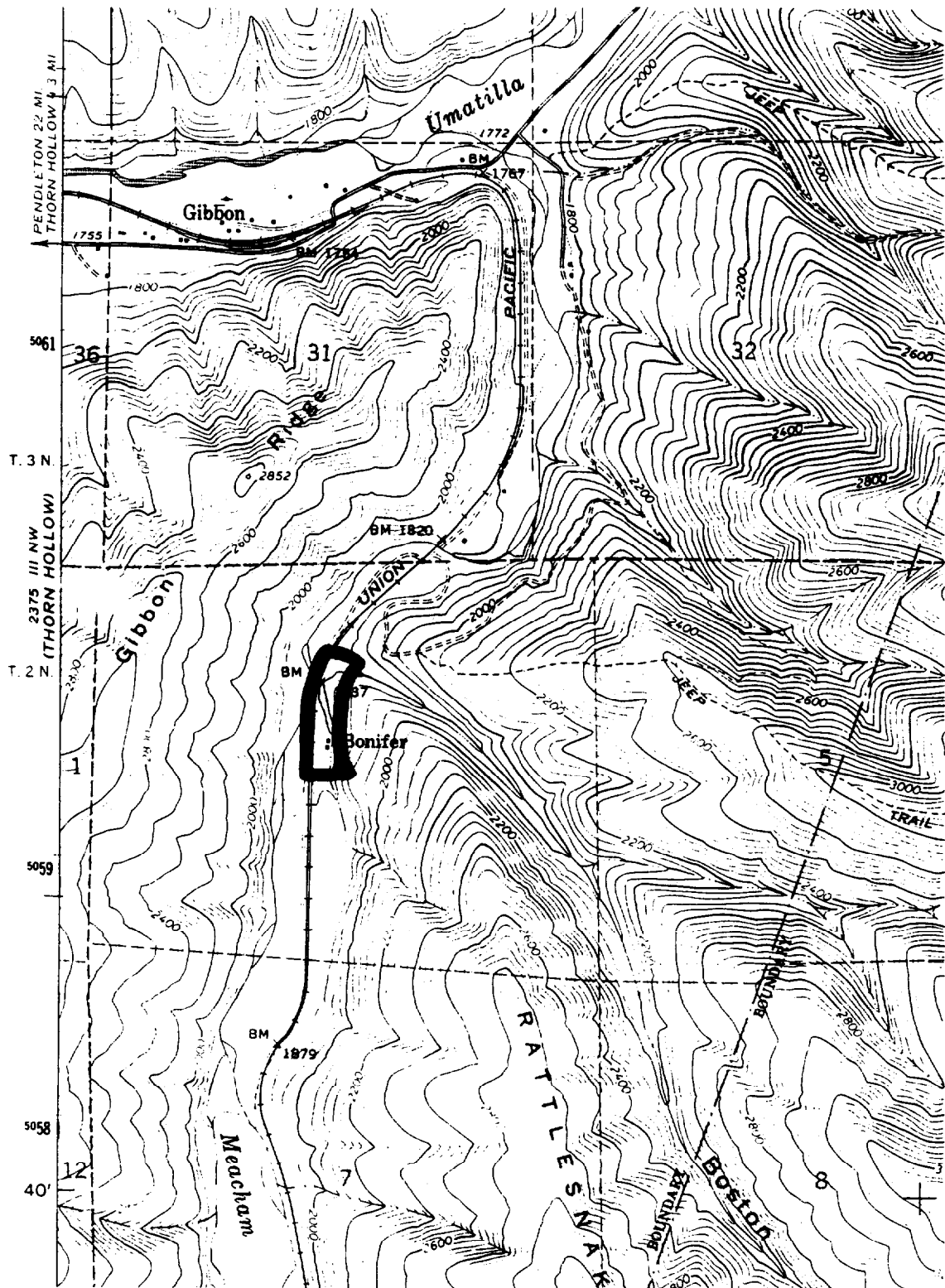
<b>RIVER BASIN</b>	<b>DATE(S) VISITED</b> 1/23/91
<b>SITE NAME</b>	Umatilla, Meacham Creek drainage
<b>SITE LOCATION</b>	Meacham Creek above N. Fork Meacham confluence
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Off County Road <b>900</b> on the south side just east of RR crossing of road at Gibbon, 16 miles up RR ROW to confluence of N. Fork Meacham Creek and mainstem, RR ROW fords Meacham Creek at this location.
<b>River Mile</b>	Mile 15 on Meacham Creek
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton
<b>USGS 7.5' Quad Ref.</b>	Duncan, OR
<b>section 34 and 35</b>	<b>Township T1N Range R36E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Private, unknown
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 276409
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	16 miles from county road 900, on gravel RR ROW.
<b>Proximity to power</b>	Powerlines along RR ROW
<b>Size (acres)</b>	undetermined, no specific site located within this general area.
<b>General topography</b>	Heavy river rocks, former stream channel and gravel bars
<b>General soil type</b>	minimal soil, large river rocks
<b>Erosion potential</b>	High
<b>Flood potential and history</b>	High, old stream side channels throughout reach
<b>Upstream land use</b>	Forested, logging
<b>Water rights</b>	
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	Possible using upstream intake, but no visible stable channel for intake, extreme <b>bedload</b> movement. Difficult to develop permanent intake site.
<b>Groundwater evaluation</b>	No known wells in area.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	<b>Mainstem</b> Meacham Creek flows underground during low flow stages. Very high <b>bedload</b> movement. No stable pools visible.
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	Coniferous forest with grassland, steep hillside
<b>Wetlands</b>	Old stream channels forming wet, small <b>ponded</b> areas, beaver activity, RR cut off old stream meander on west side of tracks.
<b>Permitting Considerations</b>	



Meacham Creek at Camp Creek

DATE(S) VISITED	1/23/91
RIVER BASIN	Umatilla, Meacham Creek drainage
SITE NAME	Meacham Creek at Camp Creek
SITE LOCATION	
County	Umatilla
Road Access Directions	Off County Road 900 on the south side just east of RR crossing of road at Gibbon, 11 miles up RR ROW to Camp Creek, at RR ROW bridge over Meacham Creek, site located immediately south and west of bridge.
River Mile	Mile 11 on Meacham Creek
USGS 1:100,000 Quad Ref.	Pendleton, OR
USGS 7.5' Quad Ref.	Duncan, OR
Section 8 and 9	Township T1N Range R36E
OWNERSHIP	
Owner Name	Private, unknown
Contact Name	Don Sampson, CTUIR
- P h o n e	(503) 2764109
zoning	
Land Use /Jurisdiction	
<b>GENERAL CHARACTERISTICS</b>	
Proximity to road	11 miles from county road 900, on gravel RR ROW. Access to site requires crossing 2 major bridges over Meacham Creek and 3 bridges over small drainages to Meacham Creek. Structural investigations of bridge integrity should be undertaken prior to development of any facility at this site.
Proximity to power	Powerline along RR ROW.
size (acres)	4 acres (estimated)
-	Flat, grass covered
General soil type	Alluvial
Erosion potential	Low
Flood potential and history	Low
Upstream land use	Forested with RR adjacent to Creek
Water rights	
<b>WATER SUPPLY</b>	
Gravity supply evaluation	Potential gravity intake 400 + yards upstream of site.. This intake area may not be stable enough for river grade control. Gravity intake would require river grade control structure and pipeline bored under railroad tracks. Deep pool located immediately adjacent to site. Pool appears to be stable enough for pumped intake location.
Groundwater evaluation	Unknown. No existing wells located within 9 miles of the site.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
Adjacent stream habitat	Meacham Creek above site, high to very high bedload movement, deep stable pool with riffle below and immediately adjacent to site
Anadromous fish	Present above site
Upland habitat type	Coniferous forest with grassland
Wetlands	none
Permitting Considerations	river diversion, intake, water rights



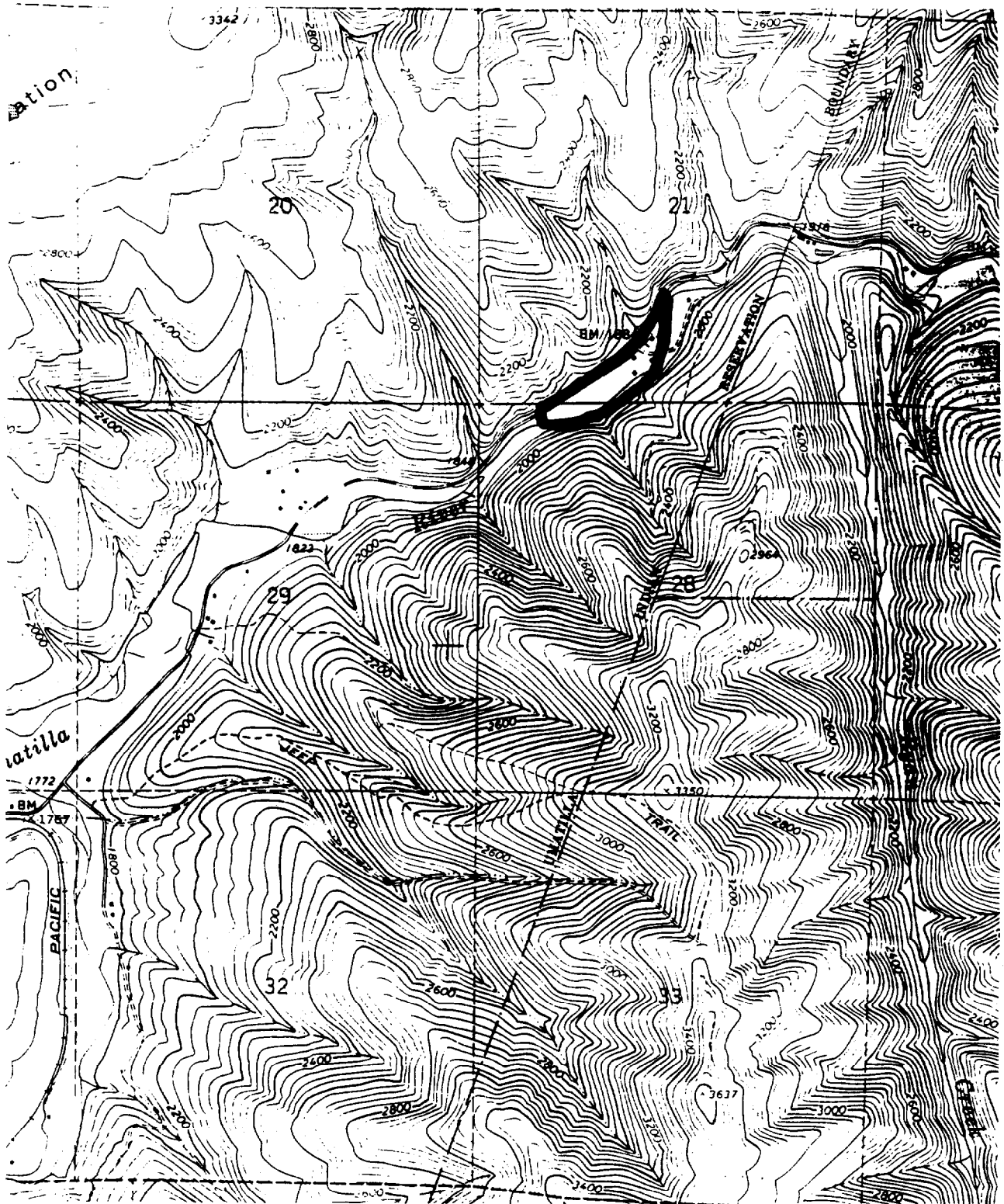


**Meacham Creek at Bonifer Springs**

DATE(S) VISITED	1/23/91
<b>RIVER BASIN</b>	Umatilla, Meacham Creek Drainage
<b>SITE NAME</b>	Meacham Creek at Bonifer Springs
SITE LOCATION	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Off County Road 900 on the south side just east of RR crossing of road at Gibbon, approx. 2 miles up Union Pacific RR ROW
<b>River Mile</b>	Meacham Creek - 2.5, Umatilla - 79
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR
USGS 7.5' Quad Ref. section NW6	Gibbon, OR
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Private property leased by CTUIR
<b>Contact Name</b>	Don Sampson
<b>Contact Phone</b>	(503) 2764109
<b>Zoning</b>	
Land Use /Jurisdiction	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Approximately 2 miles from county road. Access road is gravel, first mile very rough. U.P. Railroad bridge over Meacham Creek of questionable structural integrity. This should be investigated prior to further development of any facility on Meacham Creek.
<b>Proximity to power</b>	3 phase at site
<b>Size (acres)</b>	Questionable land available immediately adjacent to river for facility. Potential land available south of existing pond.
<b>General topography</b>	Low lying land with existing shallow pond developed as rearing facility. 2 permanent springs supply water.
<b>General soil type</b>	rocky lowland
<b>Erosion potential</b>	Low
<b>Flood potential and history</b>	Low
<b>Upstream land use</b>	Forested, grass slope
<b>Water rights</b>	not determined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	2 springs have a combined flow of approx. 2 cfs. Boston Creek ephemeral, heavy <b>bedload</b> movement. Meacham Creek needs pumping and requires boring under RR tracks.
<b>Groundwater evaluation</b>	Two wells located approximately 1 mile down Meacham Creek from Bonifer. A log of a 109 foot well reported 80 gpm at <b>zero ft. drawdown</b> after a 2 hour pump test. Log of a 164 foot well reported 27 gpm with 4 feet <b>drawdown</b> after 2 hour pump test.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Meacham Creek is very rocky, high <b>bedload</b> movement.
<b>Anadromous fish</b>	Not directly, only if Meacham Creek water added to system.
<b>Upland habitat type</b>	Coniferous forest, grassland.
<b>Wetlands</b>	Bonifer springs.
<b>Permitting Considerations</b>	

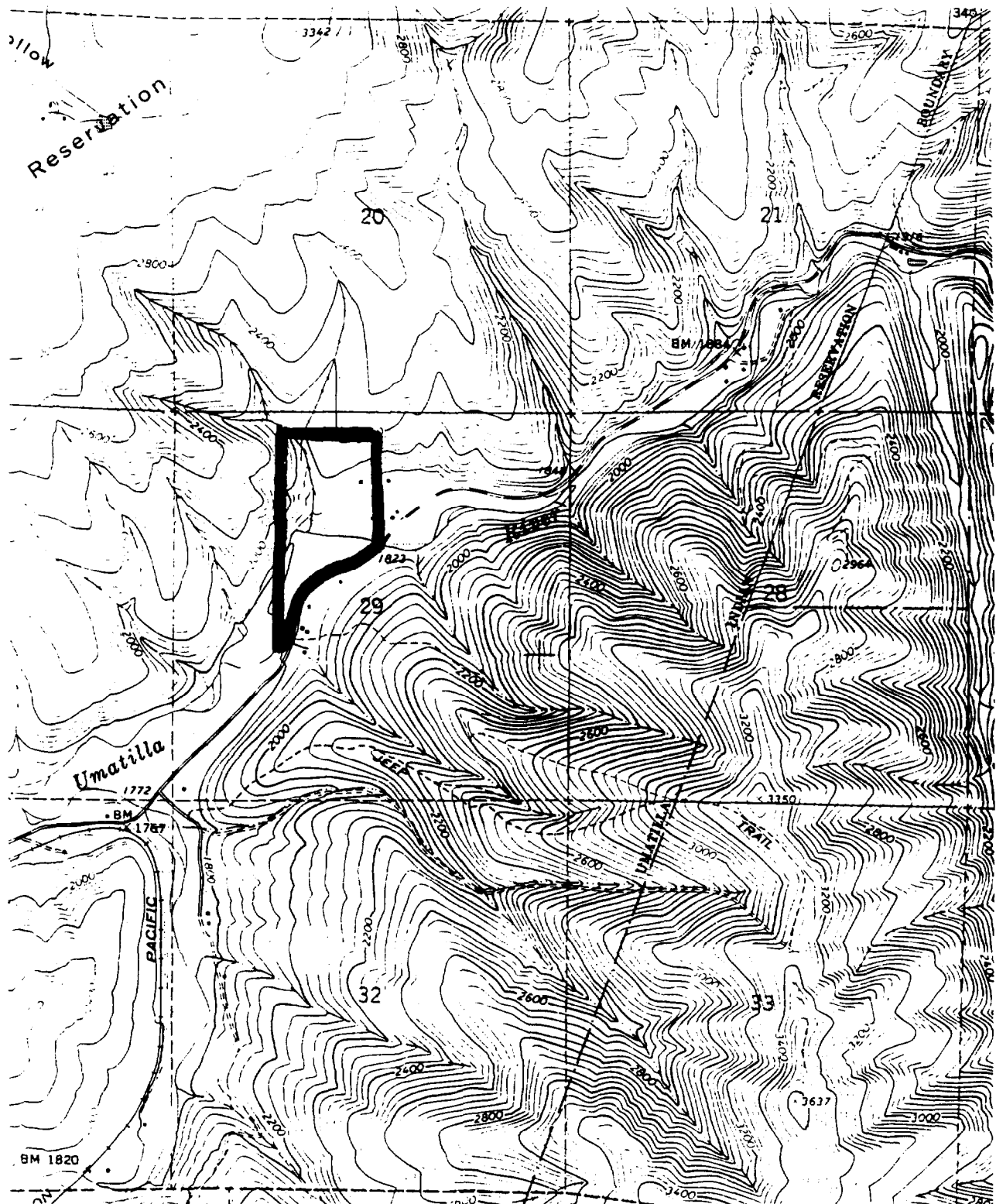
A-8

<b>DATE (S) VISITED</b>	1/22/91		
<b>RIVER BASIN</b>	Umatilla		
<b>SITE NAME</b>	Corporation		
<b>SITE LOCATION</b>	Umatilla River at USFS Corporation Guard Station		
<b>County</b>	Umatilla		
<b>Road Access Directions</b>	33 miles east of Pendleton on County Road 900 to USFS Corporation Guard Station. Approximately 2 miles above Bingham Springs (Bar M Ranch) and 0.6 miles below confluence of North and South Forks, Umatilla River.		
<b>River Mile</b>	89		
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR		
<b>USGS 7.5' Quad Ref.</b>	Bingham Springs, OR		
<b>Section</b>	<b>21</b>	<b>Township</b>	<b>T3N Range R37E</b>
<b>OWNERSHIP</b>			
<b>Owner Name</b>	US Forest Service		
<b>Contact Name</b>	Don Sampson, CTUIR		
<b>Contact Phone</b>	(503) 2764109		
<b>Zoning</b>			
<b>Land Use /Jurisdiction</b>	A-G (Developed recreation)		
<b>GENERAL CHARACTERISTICS</b>			
<b>Proximity to road</b>	On County Road 900, gravel, 2 miles above paved road.		
<b>Proximity to power</b>	Power on site, type unknown		
<b>Size (acres)</b>	5.8		
<b>General topography</b>	Approximately 4 acres relatively level, elevation 2290 ft.		
<b>General soil type</b>	Alluvial		
<b>Erosion potential</b>	Low		
<b>Flood potential and history</b>	Low, history unknown		
<b>Upstream land use</b>	Wilderness area on N. Fork, Logging on S. Fork		
<b>Water rights</b>	unknown		
<b>WATER SUPPLY</b>			
<b>Gravity supply evaluation</b>	Diversion structure required. One potential gravity diversion structure 1500 feet upstream on mainstem, pumped diversion structure adjacent to site. A second gravity intake located on the North Fork, approximately 300 yards upstream of the "Forks". This would require an estimated 3000 feet of pipe from the intake site to Corporation. Significant amount of rock excavation is required for this pipeline alignment.		
<b>Groundwater evaluation</b>	Two groundwater wells at 60 feet and 237 feet deep in <b>fractured</b> basalt yielding 60 gpm and 54 °F. No deep wells developed. Potential for developing groundwater supply in excess of 1 cfs considered low.		
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>			
<b>Adjacent stream habitat</b>	Free-stone; pool riffle/run; moderate (normal) expected <b>bedload</b> movement		
<b>Anadromous fish</b>	Chinook above site		
<b>Upland habitat type</b>	Forested, steep slope grassland		
<b>Wetlands</b>	None, spring on hillside above site.		
<b>Permitting Considerations</b>	Consistency of facility with USFS recreation uses.		



Emmett Williams

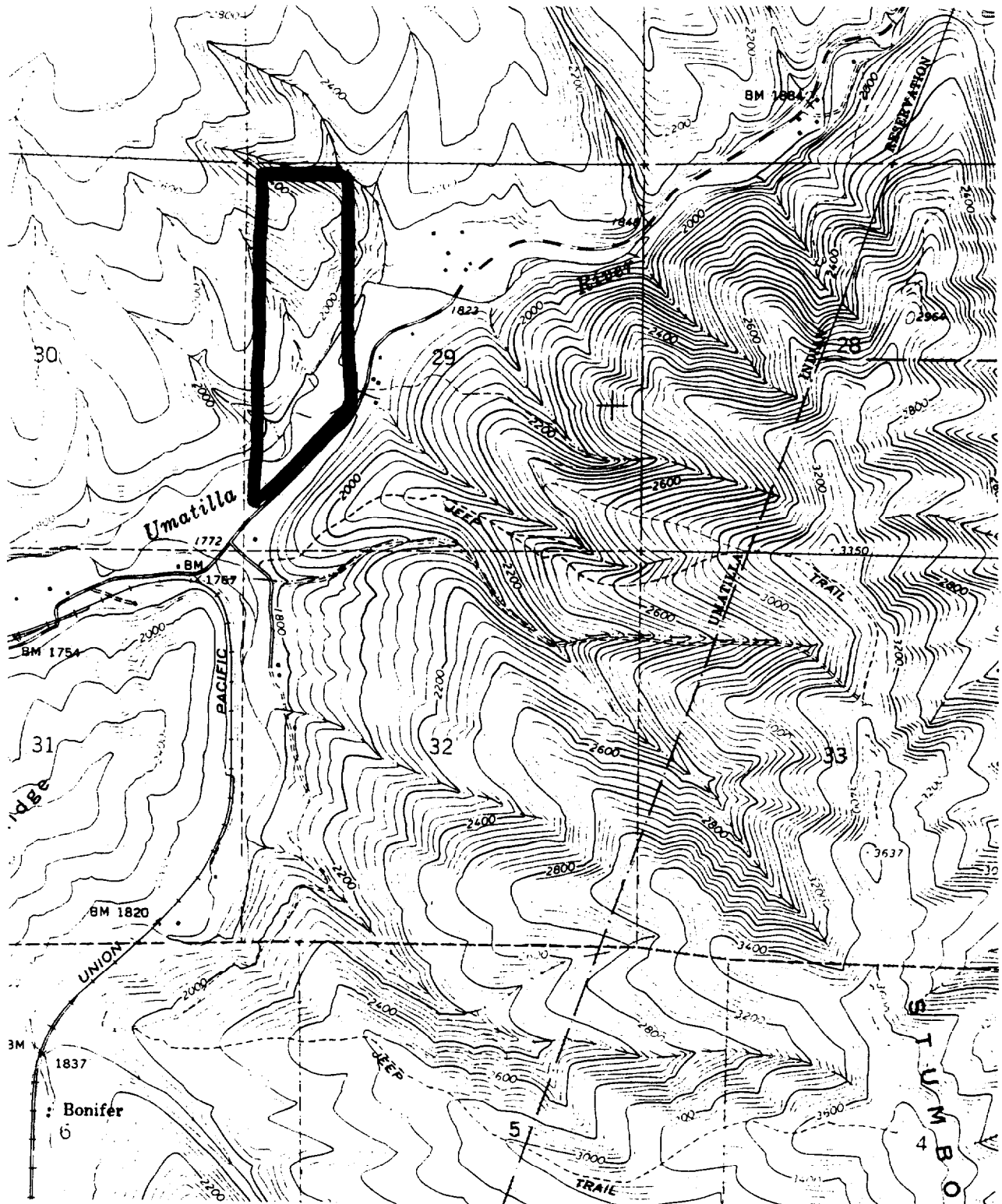
DATE(S) VISITED	1/22/91
RIVER BASIN	Umatilla
SITE NAME	Emmett Williams
SITE LOCATION	
County	Umatilla
Road Access Directions	County Road 900, approximately 27 miles east of Pendleton, at #245, Lavadour (on mailbox).
River Mile	81
USGS 1:100,000 Quad Ref.	Pendleton, OR
USGS 76' Quad Ref.	Gibbon, OR
Section 21 (SE of SW)	Township 3 N Range 36E
OWNERSHIP	
Owner Name	Emmett Williams
contact Name	Don Sampson, CTUIR
Contact Phone	(503) 2764109
Zoning	G-1
Land Use /Jurisdiction	Umatilla Indian Reservation
GENERAL CHARACTERISTICS	
Proximity to road	Adjacent to County Road 900, paved.
Proximity to power	3 phase power on site.
Size (acres)	40 acres, approximately 10 developable
General topography	Flat with relatively steep bank at river
General soil type	Alluvial
Erosion potential	Bank protected by cobbles, erosion potential low
Flood potential and history	Low, site high above river
Upstream land use	Permanent homes on large lots. Site just downstream on Ryan Creek. Bar M Ranch upstream of site.
Waterrights	
WATER SUPPLY	
Gravity supply evaluation	USGS gage #14020000 on site (Umatilla River above Meacham Creek at Gibbon). Upstream end about 10 feet above river elevation. 90 feet from centerline of road to edge of river on upstream end of property. River gradient low, need to go upstream for gravity intake. Need about 50% of base flow for Umatilla production. Diversion structure required for gravity supply, approximately 500 feet upriver. Pipeline would have to be routed down asphalt road.
Groundwater evaluation	Diversion structure may not be required for pumped supply. Emmett Williams well (State well no 3N-36E-2/d) 200 gpm at 53 °F, 15 psi. Well drilled to a depth of 230 feet at which point it entered a layer (thickness unknown - at least 8 ft.) of red cinder and small gravel. Lavadour well yielded 7 gpm at 54 °C, at 140 ft. depth in fractured gray basalt. Potential groundwater supply in excess of 500 gpm from red cinder and small gravel zone. Test well needed to determine groundwater potential
ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS	
Adjacent stream habitat	Free-stone type river, boulder/riffle, moderate bedload movement.
Anadromous fish	Present above site
Upland habitat type	Mixed conifer-deciduous forest, some cleared land
Wetlands	None
Permitting Considerations	



**Fred Gray - 27 acres**

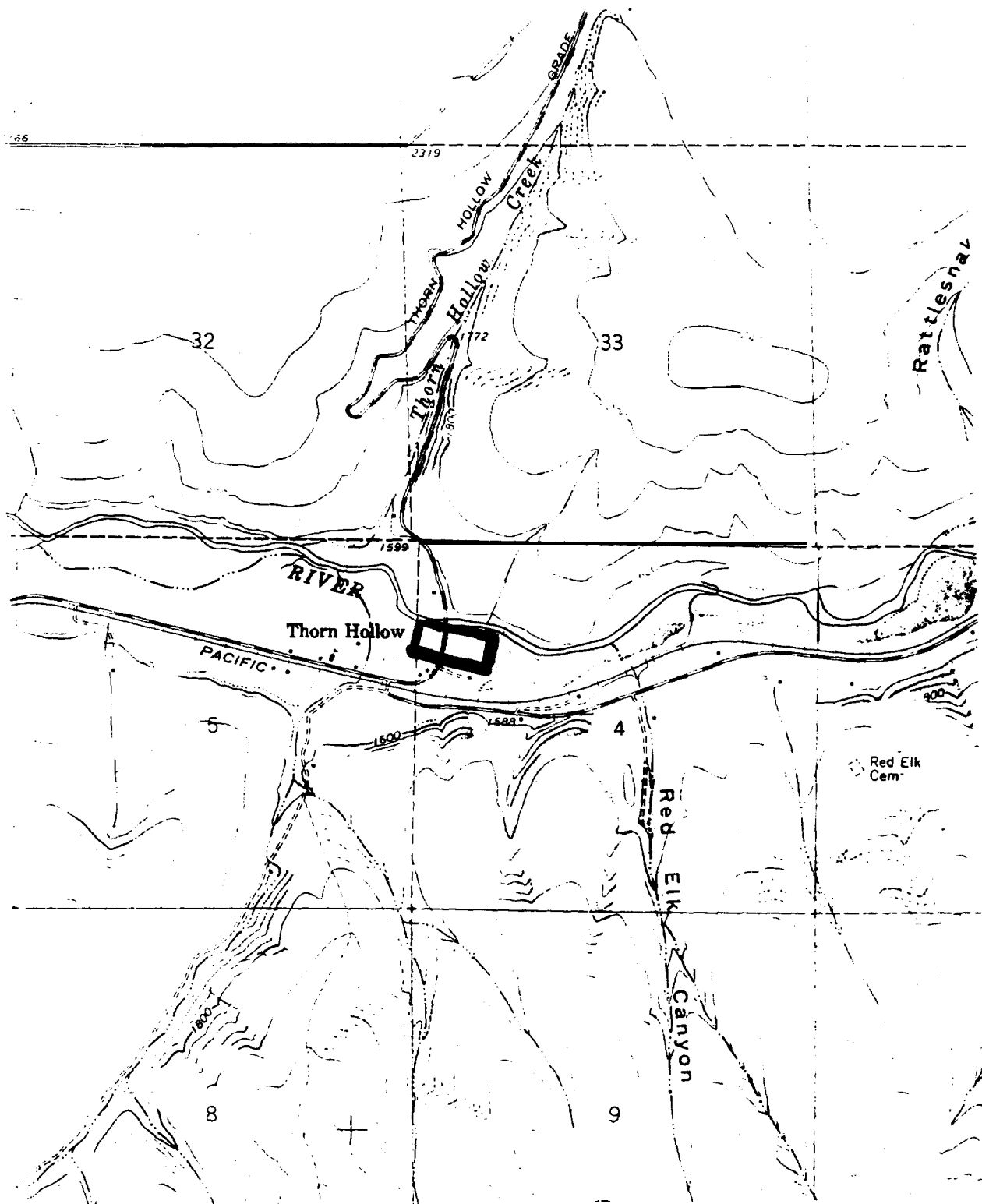
<b>DATE(S) VISITED</b>	<b>1/22/91</b>			
<b>RIVER BASIN</b>	Umatilla			
<b>SITE NAME</b>	<b>Fred Gray-27 acre</b>			
<b>SITE LOCATION</b>				
<b>County</b>	Umatilla			
<b>Road Access Directions</b>	East of Pendleton, OR on county road 900, near milepost 21 before Umatilla River bridge. Pasture on north side of road, below at bridge crossing.			
<b>River Mile</b>				
<b>USGS 1:100,000 Quad Ref.</b>				
<b>USGS 75' Quad Ref.</b>	Gibbon, OR			
<b>Section 29</b>	<b>Township</b>	<b>T3N</b>	<b>Range</b>	<b>R36E</b>
<b>OWNERSHIP</b>				
<b>Owner Name</b>	<b>Fred Gray</b>			
<b>Contact Name</b>	Don Sampson, CTUIR			
<b>Contact Phone</b>	(503) 2764109			
<b>zoning</b>				
<b>Land Use /Jurisdiction</b>	G-1 (Big-game wintering zone), Umatilla Indian Reservation			
<b>GENERAL CHARACTERISTICS</b>				
<b>Proximity to road</b>	<b>Adjacent</b> to County road 900, paved.			
<b>Proximity to power</b>	3 phase power on site			
<b>Size (acres)</b>	27 acres			
<b>General topography</b>	Flat, pasture rimmed with trees, 4 acres developable			
<b>General soil type</b>	Alluvial			
<b>Erosion potential</b>	Low			
<b>Flood potential and history</b>	Low, history unknown			
<b>Upstream land use</b>	Private land, some residential and pasture			
<b>Water rights</b>	not determined			
<b>WATER SUPPLY</b>				
<b>Gravity supply evaluation</b>	Need intake upstream past bridge for gravity supply. Very low gradient adjacent to site. Pumped intake required			
<b>Groundwater evaluation</b>	Well on site. Static - 63 <b>ft.</b> - Total depth 92 <b>ft.</b> - 30 gpm with 21 <b>ft. drawdown</b> in 2.5 hrs. 92 <b>ft.</b> hard basalt. Six domestic well logs identified in area. All wells terminated in black or grey basalt zone at a maximum depth of 245 feet. Highest yielding well had 200 gpm with extreme draw down after short pumping periods.			
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>				
<b>Adjacent stream habitat</b>	Well mixed riffle-pool stretches, moderate <b>bedload</b> movement.			
<b>Anadromous fish</b>	Present upstream			
<b>Upland habitat type</b>	Pasture, fringe of deciduous and conifer trees.			
<b>Wetlands</b>	None			
<b>Permitting Considerations</b>				





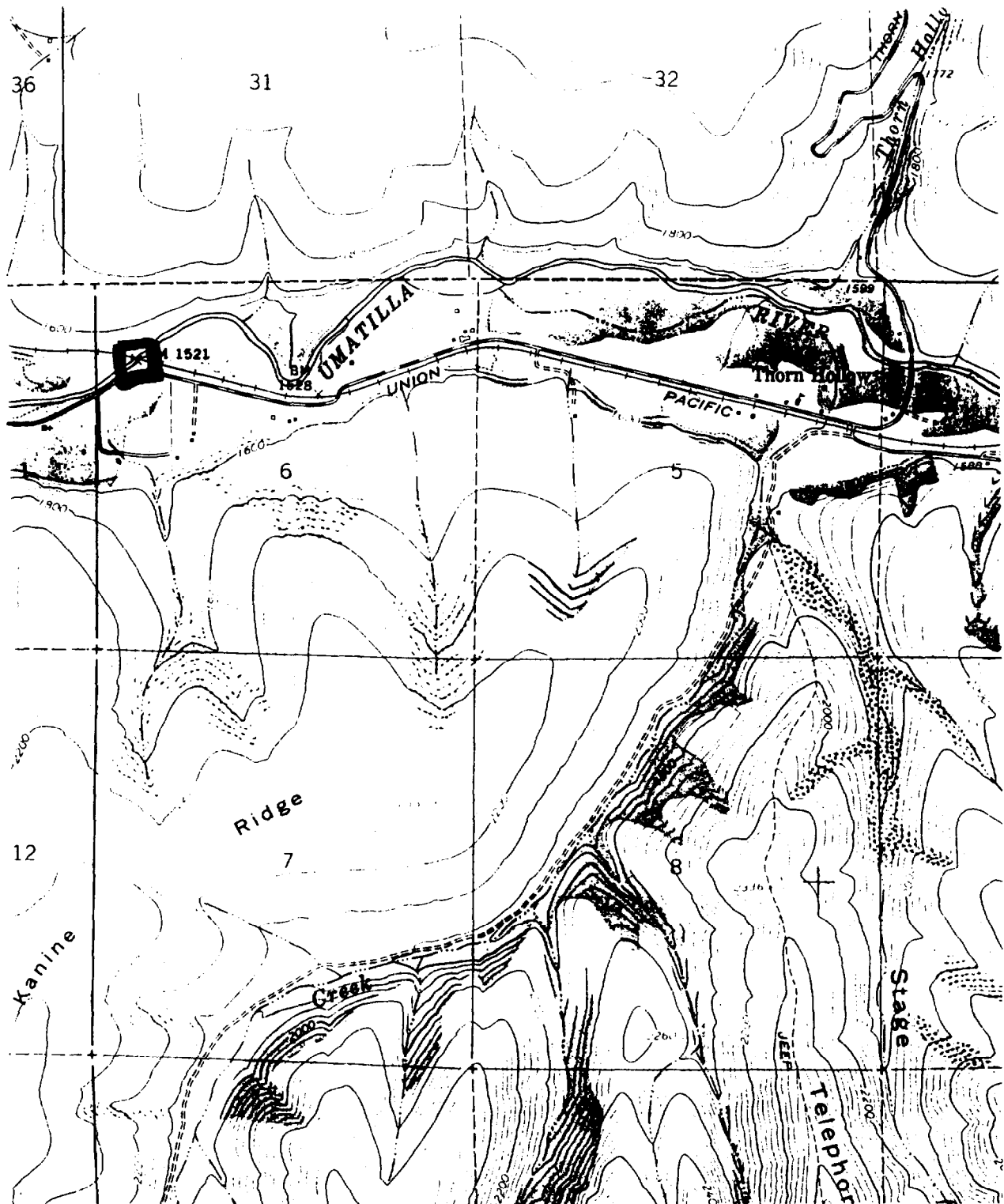
**Fred Gray - 80 acres**

<b>DATE(S) VISITED</b>	1/22/91, 1/23/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Fred Gray-80 acre
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	County road 900 on north side of road, near milepost 21 before Umatilla River bridge. Pasture just upstream of Meacham Creek confluence, orange traffic cones on barbed wire fence at entrance.
<b>River Mile</b>	80
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR
<b>USGS 75' Quad Ref.</b>	Gibbon, OR
<b>Section 29</b>	<b>Township T3N Range R36E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Fred Gray
<b>contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 2764109
<b>Zoning</b>	
<b>Land Use/Jurisdiction</b>	G-1 (Big-game wintering zone), Umatilla Indian Reservation
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Adjacent to County road 900, paved.
<b>Proximity to power</b>	3 phase power adjacent to site.
<b>Size (acres)</b>	80 acres
<b>General topography</b>	Flat, hay field and pasture, 4 + acres developable.
<b>General soil type</b>	Alluvial
<b>Erosion potential</b>	Low, some channel protection at lower end. CTUIR currently stabilizing area at western end; some previous bank erosion due to river side channel.
<b>Flood potential and history</b>	Low, history unknown.
<b>Upstream land use</b>	Private land, some residential and pasture
<b>Water rights</b>	not determined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	Potential site at head of riffle; directly adjacent to major draw on north side of river at west end of 27 acre site. Would require pipeline encroachment onto 27 acre site. Diversion structure required for both pumped and gravity.
<b>Groundwater evaluation</b>	Well on adjacent 27 acre site. Static - 63 ft. - Total depth 92 ft. - 30 gpm with 21 ft. drawdown in 2.5 hrs. 92 ft. hard basalt. Six domestic well logs identified in area. All wells terminated in black or grey basalt zone at a maximum depth of 245 feet. Highest yielding well had 200 gpm with extreme draw down after short pumping periods.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Well mixed riffle-pool stretches, moderate bedload movement.
<b>Anadromous fish</b>	Present upstream
<b>Upland habitat type</b>	Pasture.
<b>Wetlands</b>	None
<b>Permitting Considerations</b>	



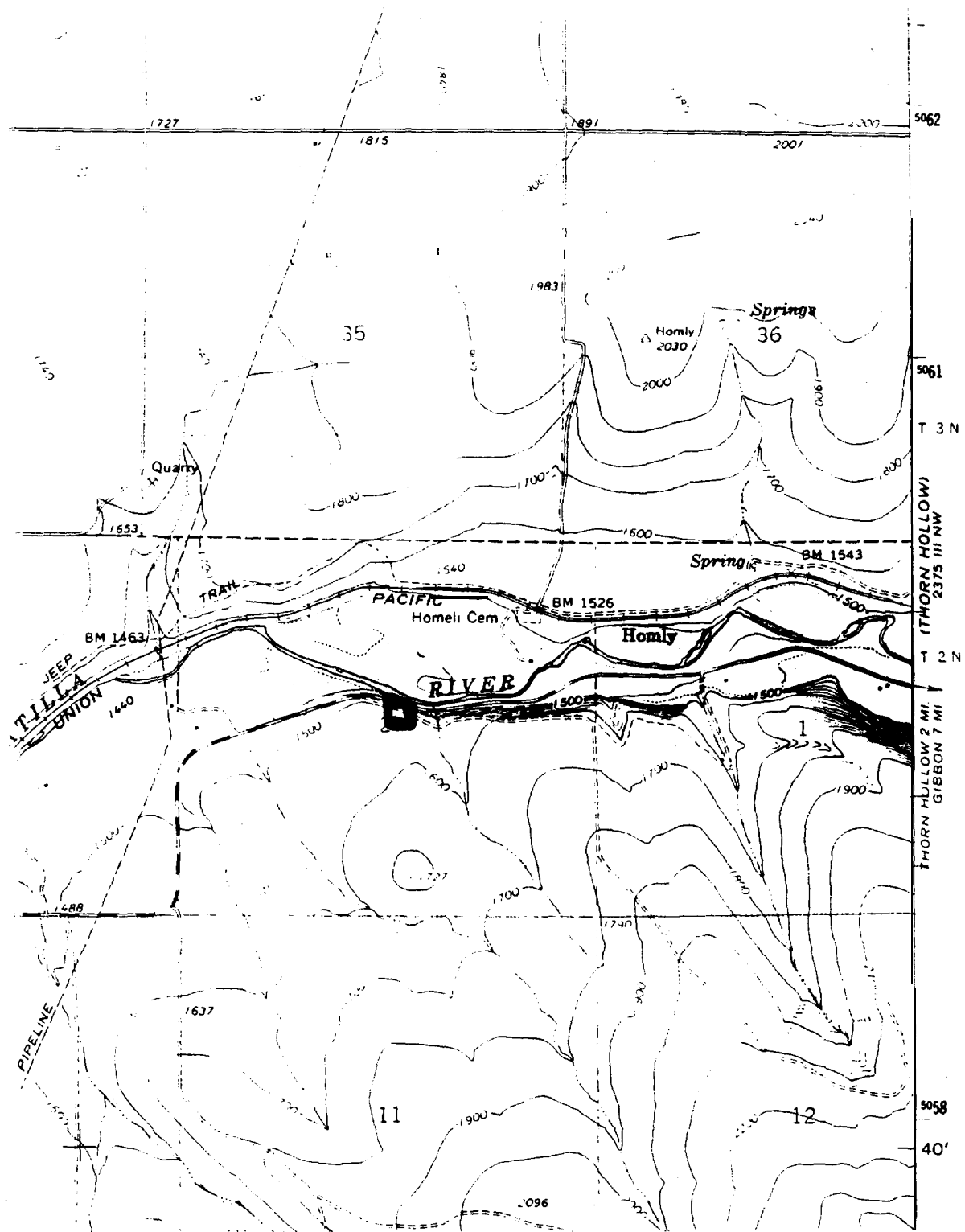
**Thorn Hollow**

<b>DATE(S) VISITED</b>	1/23/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Thorn Hollow
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Thorn Hollow Road off County Road 900, approximately 1/4 mile to bridge, site at bridge.
<b>River Mile</b>	72
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR
<b>USGS 7.5' Quad Ref.</b>	Thorn Hollow, OR
<b>Section</b> S W N W 4	<b>Township</b> <b>T 2N</b> <b>Range</b> <b>R 35E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Private, unknown owner
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 2764109
<b>zoning</b>	not determined
<b>Land Use /Jurisdiction</b>	not determined
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Adjacent to paved road, short dirt lane on SW side of bridge
<b>Proximity to power</b>	3 phase within 1/8 mile
<b>Size (acres)</b>	unknown, dependent on specific side of river selected; SE and SW best location; 10 + acres estimated.
<b>General topography</b>	Level pasture on SE side, level with trees on SW side.
<b>General soil type</b>	River bottom soils and gravel
<b>Erosion potential</b>	Low
<b>Flood potential and history</b>	Low
<b>Upstream land use</b>	Agriculture and grazing
<b>Water rights</b>	
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	Very low gravity potential, good location for pumped supply intake, no diversion required.
<b>Groundwater evaluation</b>	Records of 14 domestic wells evaluated on Sections 4 and 5. Deepest well developed to 120 feet. Highest producing well test was 75 gpm artesian flow with head of 8 feet in 1969. Six of the 14 wells reported artesian flow. No well water temperature available, but it is expected to be in the mid 50 °F range. Further well testing is required to obtain groundwater development capacity in area.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Free stone river, moderate bedload movement
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	Level pasture on SE side, level with trees on SW side.
<b>Wetlands</b>	None
<b>Permitting Considerations</b>	



**Black Bridge - Cayuse**

<b>DATE(S) VISITED</b>	1/17/91, 1/22/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Black Bridge
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	County Road 900, approximately 1.5 miles west of Thorn Hollow, 3.5 miles east of <b>Cayuse</b> . Dirt turnoff on norht side of County road at railroad bridge crossing of Umatilla River.
<b>River Mile</b>	70 (approximate)
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR
<b>USGS 7.5' Quad Ref.</b>	Thorn Hollow, OR
<b>Section</b>	<b>Township</b> T 2N <b>Range</b> R 35 E
<b>OWNERSHIP</b>	
<b>Owner Name</b>	undetermined
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 2764109
<b>Zoning</b>	undetermined
<b>Land Use /Jurisdiction</b>	undetermined
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Adjacent and connected to county road.
<b>Proximity to power</b>	Powerlines along county road at site
<b>Size (acres)</b>	< 1 acre
<b>General topography</b>	slightly below road grade, flat site, 6-8 feet above river
<b>General soil type</b>	Alluvial
<b>Erosion potential</b>	undetermined
<b>Flood potential and history</b>	undetermined
<b>Upstream land use</b>	Agricultural
<b>Water rights</b>	undetermined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	not applicable, considered only as a direct release site
<b>Groundwater evaluation</b>	not applicable, considered only as a direct release site
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	relatively deep pool under bridge
<b>Anadromous fish</b>	present above site
<b>Upland habitat type</b>	pasture land
<b>Wetlands</b>	none
Permitting Considerations	



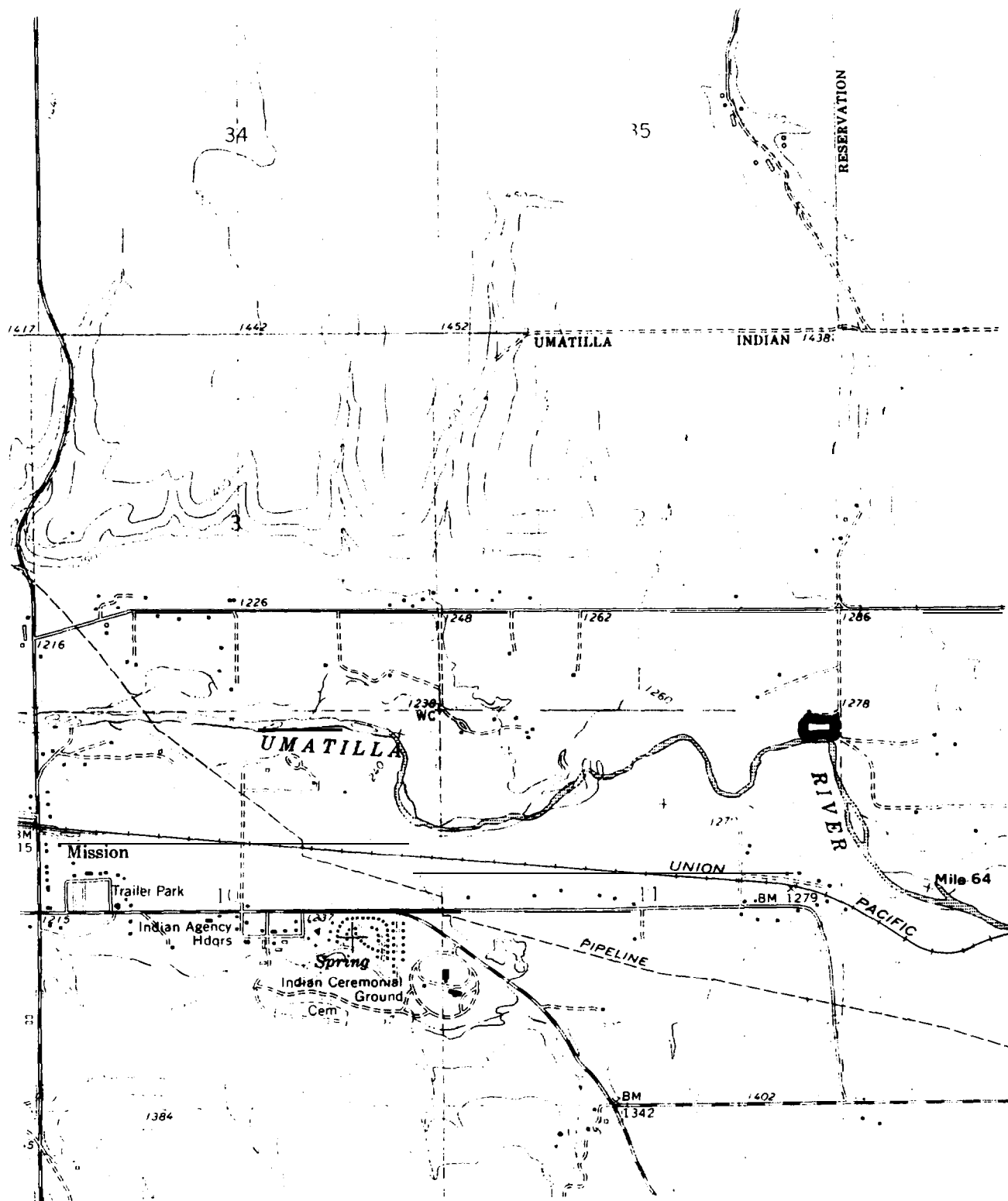
Homly

<b>DATE(S) VISITED</b>	1/23/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Homly -(current release site)
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	County Road <b>900</b> , turnout on road near <b>Cayuse</b> , Homly Cemetery.
<b>River Mile</b>	69 (approximate)
USGS <b>1:100,000</b> Quad Ref.	Pendleton, OR.
USGS <b>7.5'</b> Quad Ref.	<b>Cayuse, OR</b>
<b>Section</b> <b>SWNW 1</b>	<b>Township      T2N                      Range              R34E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Umatilla County (County Road ROW)
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 2764109
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Adjacent to road, gravel turnout 12 ft. wide, 40 <b>ft</b> long
<b>Proximity to power</b>	not determined
<b>Size (acres)</b>	75 ft. by 12 <b>ft</b> . No land available for site development.
<b>General topography</b>	Rip-rap bank, 12 feet above water
<b>General soil type</b>	Asphalt road shoulder
<b>Erosion potential</b>	none
<b>Flood potential and history</b>	n o n e
<b>Upstream land use</b>	grazing
<b>Water rights</b>	not determined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	not applicable to site
<b>Groundwater evaluation</b>	not applicable to site
<b>ENVIRONMENTAL, CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Pool/run at point of release
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	County road
<b>Wetlands</b>	none
Permitting Considerations	



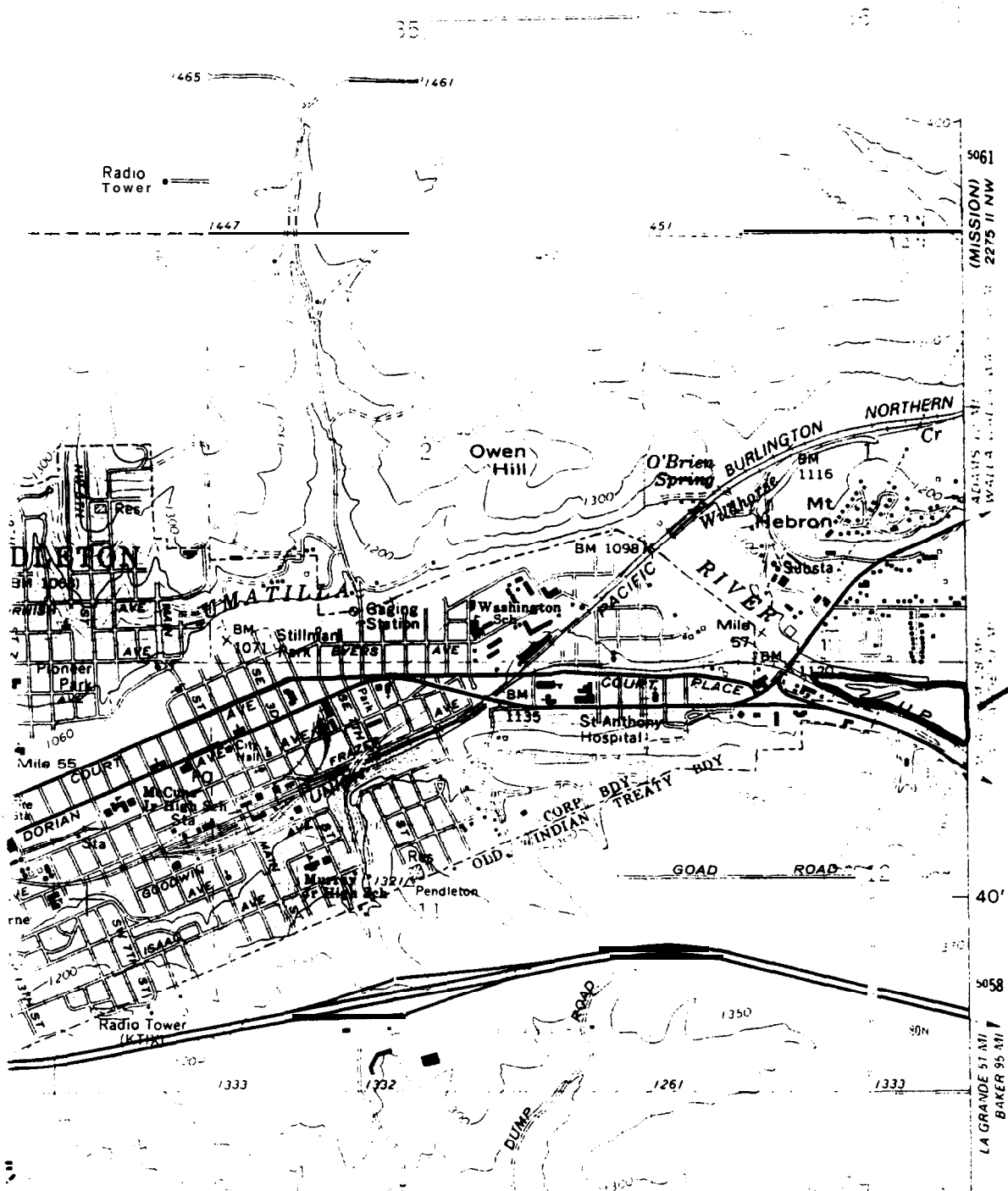


<b>DATE(S) VISITED</b>	<b>1/17/91</b>
<b>RIVER BASIN</b>	<b>Umatilla</b>
<b>SITE NAME</b>	<b>Minthorn</b>
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	County Road 900, gravel road to north off county road approximately 3.25 miles east of Mission. Drive north along gravel road towards Umatilla River, leads to facility. 65 (approximate, near existing Minthorn facility)
<b>River Mile</b>	Pendleton, OR
<b>USGS 1:100,000 Quad Ref.</b>	<b>Cayuse, OR</b>
<b>USGS 7.5' Quad Ref. section</b>	<b>Township T 2N Range R 34 E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	undetermined
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 276409
<b>Zoning</b>	undetermined
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Approximately <b>3/4</b> miles off county road on gravel road that was graded smooth at time of site visit
<b>Proximity to power</b>	<b>3-phase</b> power at site
<b>Size (acres)</b>	2 (approximate)
<b>General topography</b>	flat at site, steep slope on south side, beaver ponds and stream channel surrounding remainder of site.
<b>General soil type</b>	Alluvial
<b>Erosion potential</b>	low
<b>Flood potential and history</b>	undetermined
<b>Upstream land use</b>	agriculture, some residential
<b>Water rights</b>	Existing diversion for fish culture from beaver pond
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	undetermined
<b>Groundwater evaluation</b>	undetermined, spring development possible for expansion
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	beaver pond, side channels of Umatilla <b>mainstem</b>
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	pasture, wooded areas
<b>Wetlands</b>	beaver pond adjacent to facility
<b>Permitting Considerations</b>	Wetland construction for expanded water supply



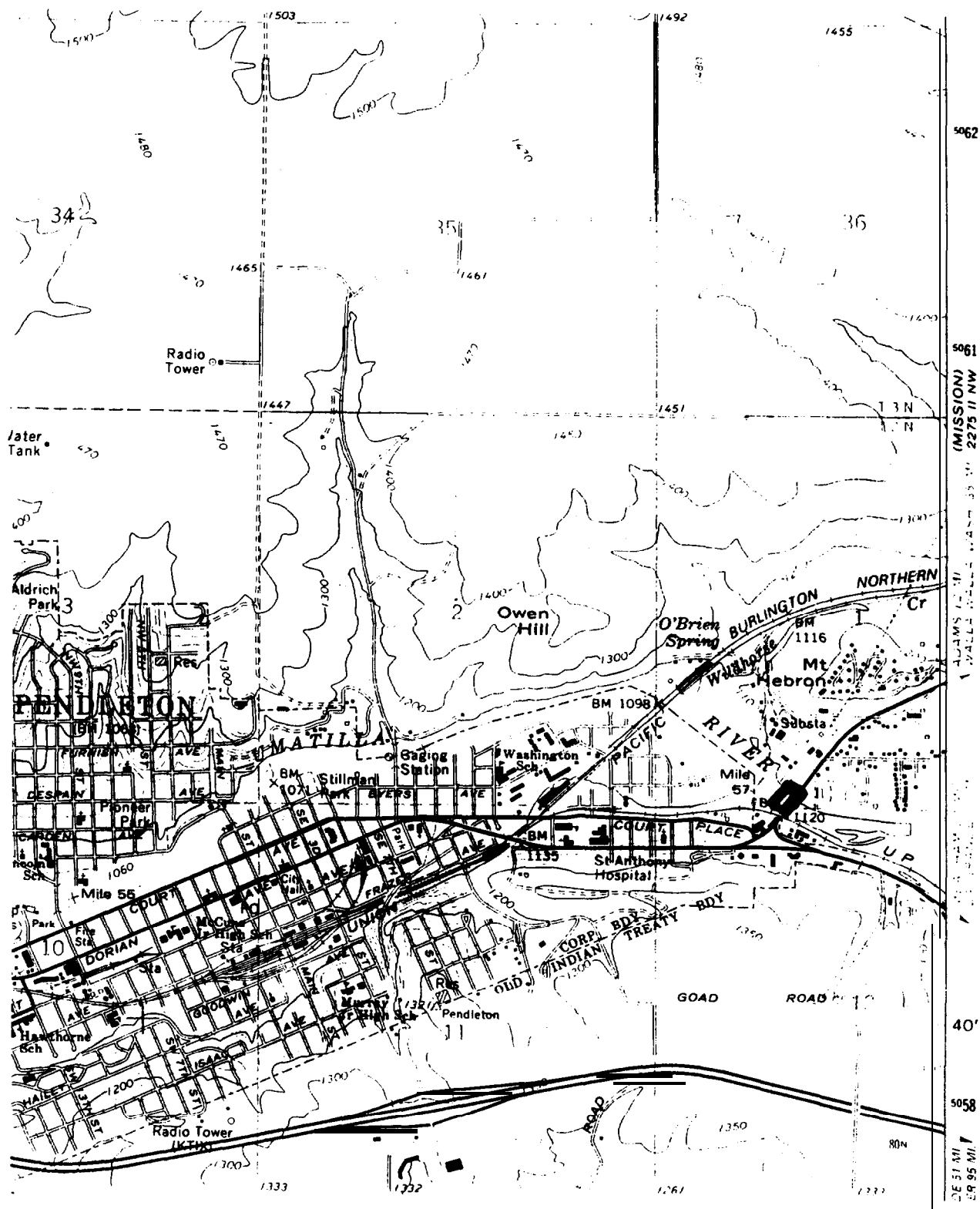
Mission

<b>DATE (S) VISITED</b>	<b>1/24/91</b>
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Mission
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	County Road 900 to Mission turnoff. North on road through Mission, approximately 1 mile to rural asphalt road intersection from east. East on this road, two miles, to 4-way intersection, south 1/3 mile to river. Site on lot on west side of road.
<b>River Mile</b>	Approx. 61
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR.
USGS 7.5' Quad Ref.	Mission, OR
<b>Section</b> 11	Township <b>T2N</b> <b>Range</b> <b>R33E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Goose & Rudolf Williams
<b>contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 276409
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	150 ft. from paved road
<b>Proximity to power</b>	3 phase at site
<b>Size (acres)</b>	Approx. 3/4 acre (building lot)
<b>General topography</b>	<b>Flat</b>
<b>General soil type</b>	Gravelly
<b>Erosion potential</b>	Dow. Steep, rip-rapped bank, approx. 10 ft. above river.
<b>Flood potential and history</b>	Low, history unknown
<b>Upstream land use</b>	<b>Agriculture</b>
<b>Water rights</b>	not determined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	<b>Difficult</b> gravity supply, should be pumped, no diversion expected
<b>Groundwater evaluation</b>	Records of 6 domestic wells indicated no artesian flows and <b>sufficient</b> groundwater for domestic use only. Maximum depth of well to <b>84</b> feet.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Free-stone, pool-riffle, moderate <b>bedload</b> movement
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	Residential, open fields
<b>Wetlands</b>	None
<b>Permitting Considerations</b>	



ODF&amp;W

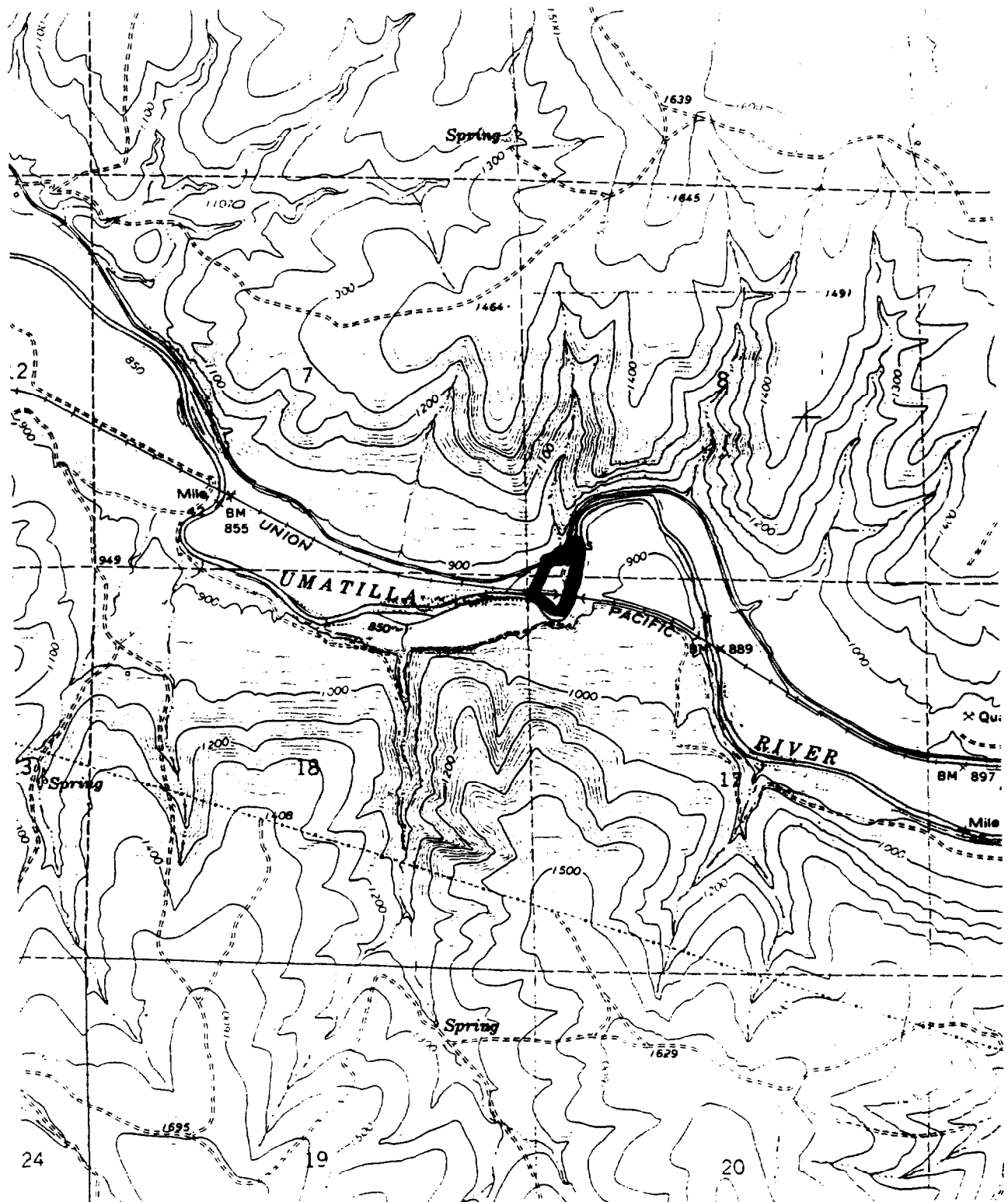
<b>DATE(S) VISITED</b>	2/19/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	ODF&W
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Highway 900 on E. side of Pendleton at ODF&W headquarters. Pasture and fields to east and north along river.
<b>River Mile</b>	Approx. 56.2
USGS 1:100,000 Quad Ref.	Pendleton, OR
USGS 76' Quad Ref.	Pendleton, OR
<b>Section</b>	<b>Township</b> <b>T2N</b> <b>Range</b> <b>R32E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Private
<b>Contact Name</b>	Jim Phelps, ODF&W
<b>Contact Phone</b>	(503)276-2344
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	100 yards from paved road
<b>Proximity to power</b>	3 phase power at site
<b>size (acres)</b>	Estimated 40 acres riparian and upland
<b>General topography</b>	flat adjacent to river, sloping uplands away from floodplain
<b>General soil type</b>	Alluvial
<b>Erosion potential</b>	Low
<b>Flood potential and history</b>	Diked on south side, old gravel mine area
<b>Upstream land use</b>	Agriculture, residential
<b>Water rights</b>	Undetermined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	good site for intake near upper end of property
<b>Groundwater evaluation</b>	undetermined
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	riparian wetlands along S. bank, side-channels with cattails, deciduous trees and wetland areas on N. bank.
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	pasture, deciduous trees, brushy slopes outside floodplain
<b>Wetlands</b>	riparian zone wetlands noted
<b>Permitting Considerations</b>	



Riverside

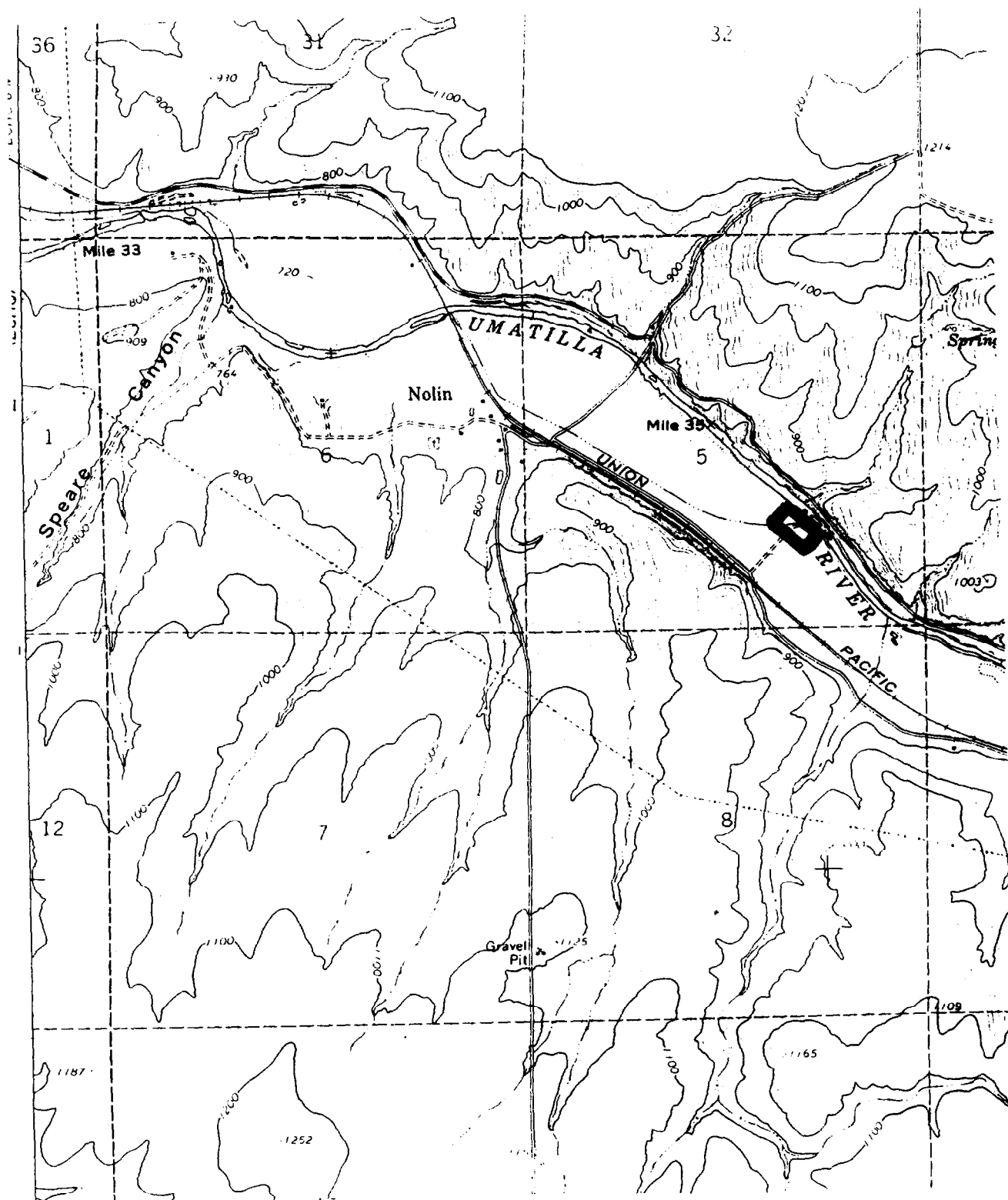
<b>DATE(S) VISITED</b>	1/24/91		
<b>RIVER BASIN</b>	Umatilla		
<b>SITE NAME</b>	Riverside (Highway 11 Bridge release site)		
<b>SITE LOCATION</b>			
<b>County</b>	Umatilla		
<b>Road Access Directions</b>	Highway 11 toward Athena on E. side of Pendleton, northwest side of bridge, dirt access road next to private nursery.		
<b>River Mile</b>	Approx. 56		
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR		
<b>USGS 7.5' Quad Ref.</b>	Pendleton, OR		
<b>Section</b>	<b>Township</b>	<b>T2N</b>	<b>Range R32E</b>
<b>OWNERSHIP</b>			
<b>Owner Name</b>	Private, unknown		
<b>Contact Name</b>	Don Sampson, CTUIR		
<b>Contact Phone</b>	(503) 276409		
<b>zoning</b>			
<b>Land Use /Jurisdiction</b>			
<b>GENERAL CHARACTERISTICS</b>			
<b>Proximity to road</b>	100 yards from paved road		
<b>Proximity to power</b>	100 yds to Highway 11		
<b>Size (acres)</b>	Estimated 0.25 acre		
<b>General topography</b>	Dirt lane, no site development potential except parking		
<b>General soil type</b>			
<b>Erosion potential</b>	Yes		
<b>Flood potential and history</b>			
<b>Upstream land use</b>	Agriculture		
<b>Water rights</b>	n/a, direct release site with no holding		
<b>WATER SUPPLY</b>			
<b>Gravity supply evaluation</b>	n/a, direct release site with no holding		
<b>Groundwater evaluation</b>	n/a, direct release site with no holding		
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>			
<b>Adjacent stream habitat</b>	Shallow side of river, riffle area.		
<b>Anadromous fish</b>	Present above site		
<b>Upland habitat type</b>			
<b>Wetlands</b>			
<b>Permitting Considerations</b>			





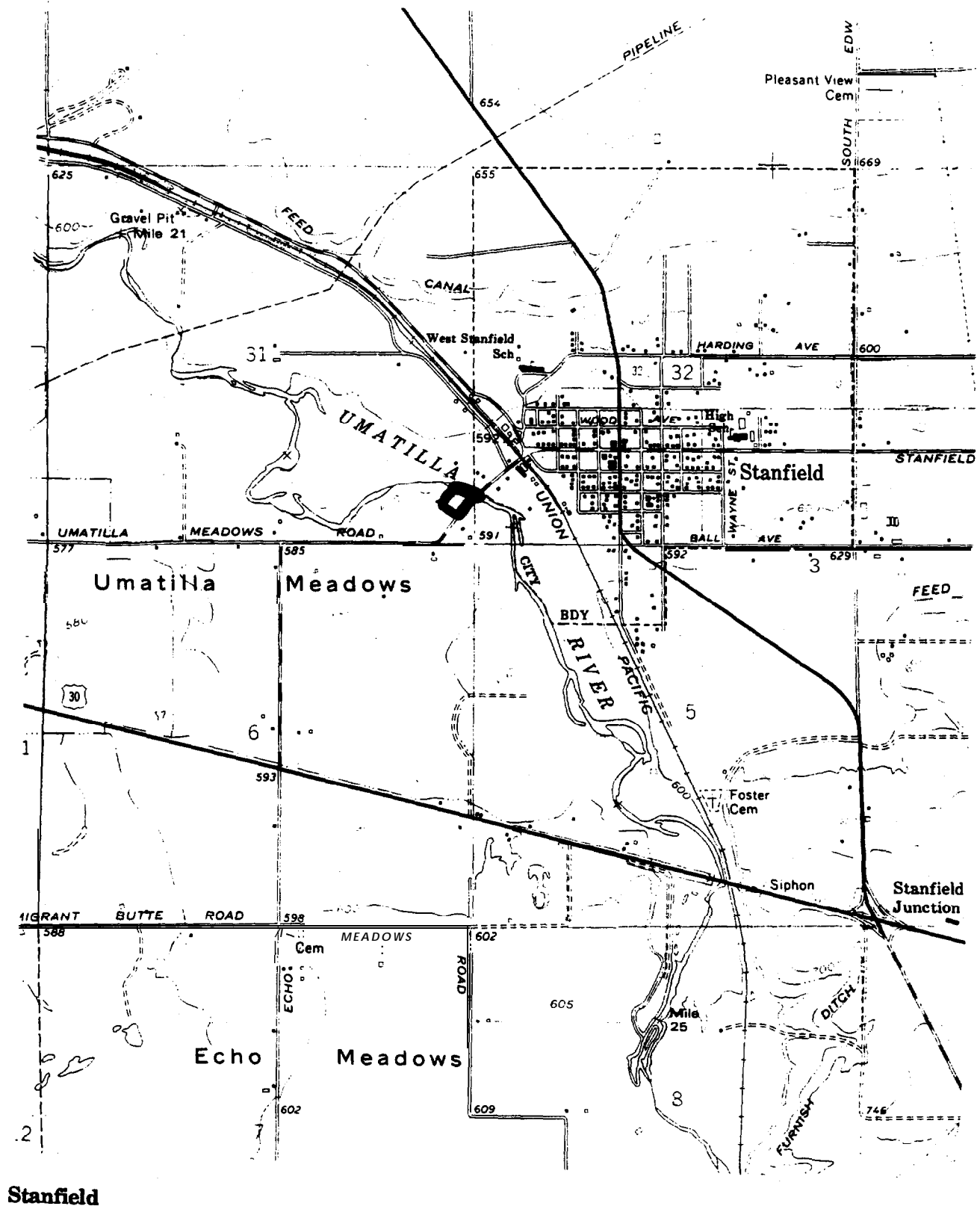
Barnhart

<b>DATE(S) VISITED</b>	1/24/91				
<b>RIVER BASIN</b>	Umatilla				
<b>SITE NAME</b>	Bamhart (existing release site)				
<b>SITE LOCATION</b>					
<b>County</b>	Umatilla				
<b>Road Access Directions</b>	Echo - <b>Pendleton</b> Hwy. Dirt lane running south off Highway across open grass field at river mile 43.25. Located where U.P. Railroad crosses river from south side to north side river.				
<b>River Mile</b>	43.25				
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR				
<b>USGS 7.5' Quad Ref.</b>	Barnhart, OR				
<b>Section</b>	<b>SESE8 &amp; NWNW17</b>	<b>Township</b>	<b>T2N</b>	<b>Range</b>	<b>R31E</b>
<b>OWNERSHIP</b>					
<b>Owner Name</b>	Unknown				
<b>Contact Name</b>	Don Sampson, CTUIR				
<b>Contact Phone</b>	(503) 2754109				
<b>Zoning</b>	not determined				
<b>Land Use /Jurisdiction</b>					
<b>GENERAL CHARACTERISTICS</b>					
<b>Proximity to road</b>	1/4 mile from paved road along dirt lane across field				
<b>Proximity to power</b>	power lines at site along RR ROW				
<b>Size (acres)</b>	Large flat field north of RR tracks approximately 10 acres. South of tracks, less than 1 acre, and suitable size for direct release only.				
<b>General topography</b>	Relatively flat				
<b>General soil type</b>	River bottom				
<b>Erosion potential</b>	<b>Low</b>				
<b>Flood potential and history</b>	<b>Low</b>				
<b>Upstream land use</b>	Agriculture				
<b>Water rights</b>	Not determined.				
<b>WATER SUPPLY</b>					
<b>Gravity supply evaluation</b>	Pumping required				
<b>Groundwater evaluation</b>	No well logs identified in area.				
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>					
<b>Adjacent stream habitat</b>	Slow river section, long run type, <b>bedload</b> movement low to moderate				
<b>Anadromous fish</b>	Present above site				
<b>Upland habitat type</b>	Open grassland field north of RR, some trees south of RR				
<b>Wetlands</b>	None				
<b>Permitting Considerations</b>					

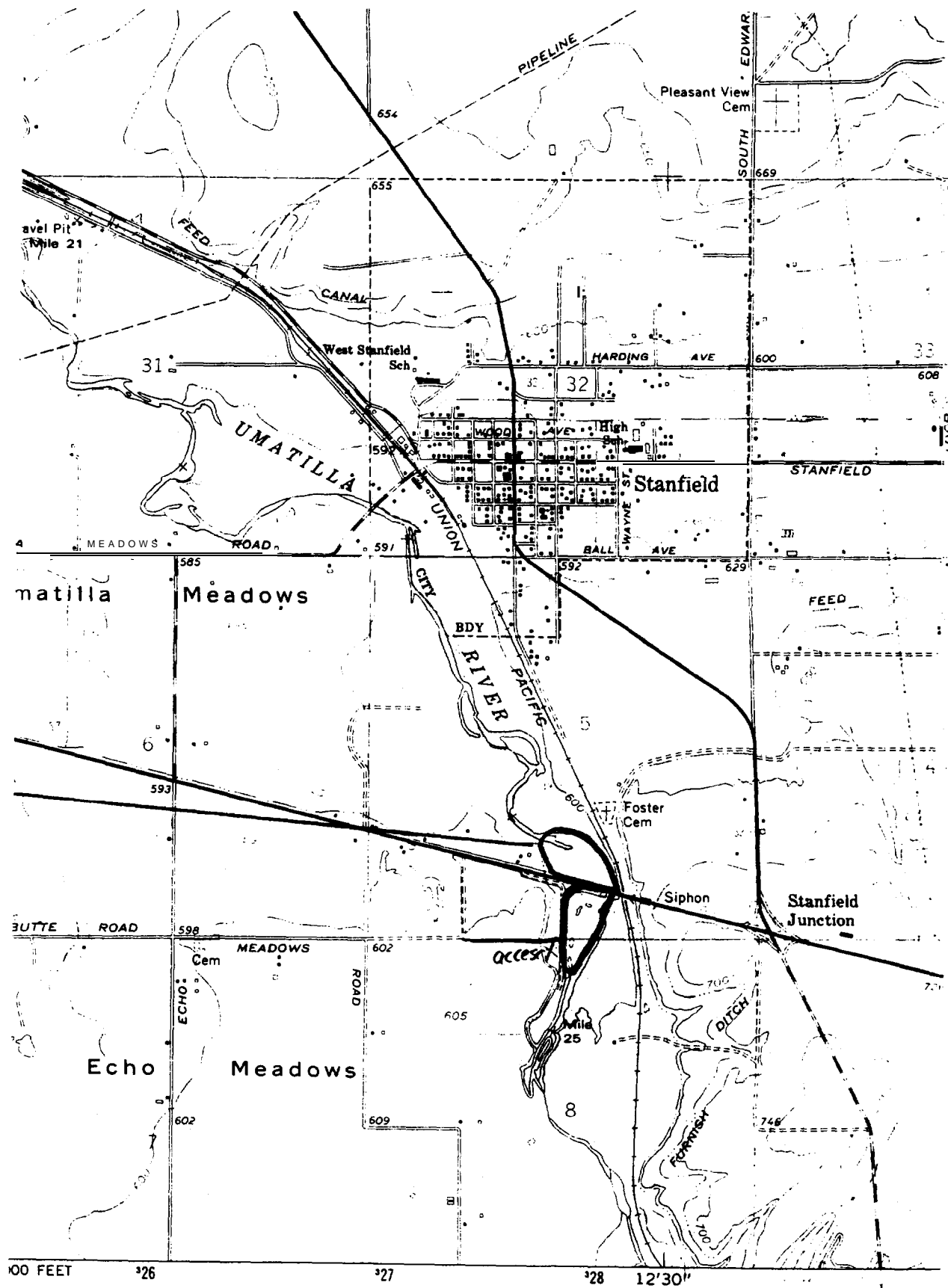


Nolin

<b>DATE(S) VISITED</b>	1/24/91		
<b>RIVER BASIN</b>	Umatilla		
<b>SITE NAME</b>	Nolin (existing release site)		
<b>SITE LOCATION</b>			
<b>County</b>	Umatilla		
<b>Road Access Directions</b>	Echo - Pendleton Hwy. South across river on asphalt road toward Nolin. 1/2 mile on gravel road adjacent to RR tracks on north side. North 0.2 miles to river on lane between two hay fields/pastures.		
<b>River Mile</b>	35		
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR.		
<b>USGS 7.5' Quad Ref.</b>	Nolin, OR.		
<b>section</b>	Center SE 5	<b>Township</b>	<b>T2N</b>
<b>OWNERSHIP</b>		<b>Range</b>	<b>R30E</b>
<b>Owner Name</b>	Cunningham Sheep Co.		
<b>contact Name</b>	Don Sampson, <b>CTUIR</b>		
<b>Contact Phone</b>	(503) 2764109		
<b>zoning</b>			
<b>Land Use /Jurisdiction</b>			
<b>GENERAL CHARACTERISTICS</b>			
<b>Proximity to road</b>	3/4 mile from paved road along good gravel road		
<b>Proximity to power</b>	3-phase power at site for existing river water irrigation pumping.		
<b>size (acres)</b>	Large fields (acreage not determined)		
<b>General topography</b>	Flat		
<b>General soil type</b>	Alluvial		
<b>Erosion potential</b>	Low		
<b>Flood potential and history</b>	L o w		
<b>Upstream land use</b>	Agriculture		
<b>Water rights</b>	Not determined		
<b>WATER SUPPLY</b>			
<b>Gravity supply evaluation</b>	Pumping required, no diversion structure required		
<b>Groundwater evaluation</b>	No groundwater wells identified in area.		
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>			
<b>Adjacent stream habitat</b>	Slow river section, long run type, <b>bedload</b> movement low to moderate, slight backwater, deep		
<b>Anadromous fish</b>	Present above site		
<b>Upland habitat type</b>	Pasture, hay field		
<b>Wetlands</b>	None		
<b>Permitting Considerations</b>			



<b>DATE@ ) VISITED</b>	<b>1/24/91</b>
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Stanfield Bridge (existing release site)
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Stanfield (N. Main Street) Highway 395 to bridge on West Coe Ave. Site located on SW side of bridge
<b>River Mile</b>	<b>23</b>
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR.
<b>USGS 76' Quad Ref.</b>	Stanfield, OR.
<b>Section SESE31</b>	<b>Township T4N</b>
	<b>Range R29E</b>
<b>OWNERSHIP</b>	
<b>Owner Name</b>	Private, unknown
<b>Contact Name</b>	Don Sampson, CTUIR
<b>Contact Phone</b>	(503) 276-4109
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	Adjacent to paved road
<b>Proximity to power</b>	Powerlines along highway adjacent to site.
<b>Size (acres)</b>	Estimated 1 acre available for direct release
<b>General topography</b>	
<b>General soil type</b>	Sandy gravel bottom land
<b>Erosion potential</b>	Moderate near river
<b>Flood potential and history</b>	Moderate near river
<b>Upstream land use</b>	Agriculture and small residential communities
<b>Water rights</b>	not determined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	Pumping required, may need diversion structure , river reach totally dewatered at times
<b>Groundwater evaluation</b>	No wells identified in area.
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Gravelly riffle/run, dewatered in summer
<b>Anadromous fish</b>	Present above site
<b>Upland habitat type</b>	Treed
<b>Wetlands</b>	None
<b>Permitting Considerations</b>	

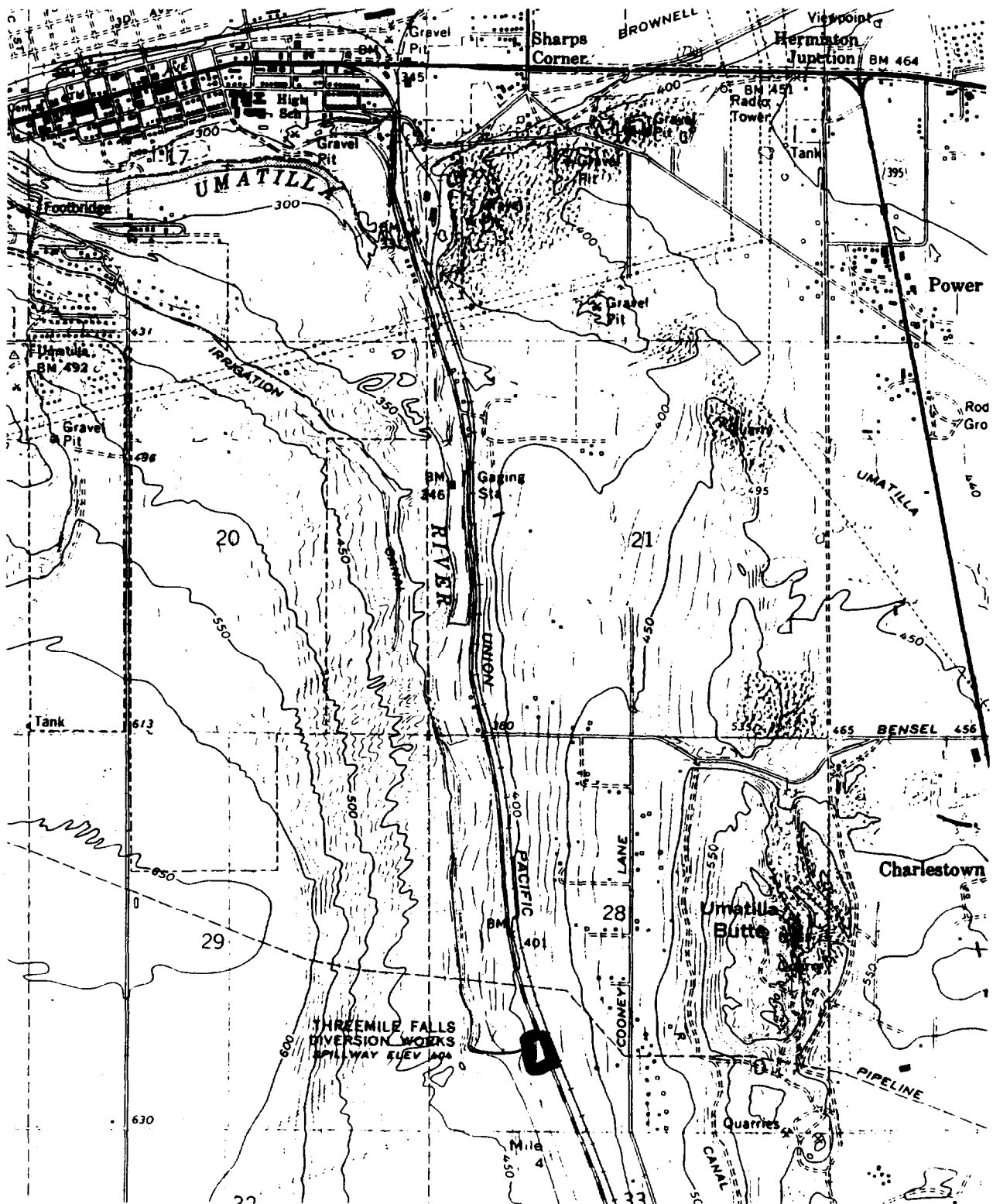


Echo Meadows

A-36

<b>DATE(S) VISITED</b>	3/8/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Echo Meadows
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	Near <b>I-84</b> bridge just west of Echo; <b>Echo Meadows</b> Rd. off of <b>Coe Avenue</b> in Riverside, heading south, then east, continue east on gravel road where paved road turns south
<b>River Mile</b>	24.2
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, Oregon
<b>USGS 7.5' Quad Ref.</b>	Stanfield, Oregon
<b>Section</b> ?	<b>Township</b> ? <b>Range</b> ?
<b>OWNERSHIP</b>	
<b>Owner Name</b>	<b>ODF&amp;W</b>
<b>Contact Name</b>	Jim Phelps, <b>ODF&amp;W</b>
<b>Contact Phone</b>	(503) 2762344
<b>Zoning</b>	
<b>Land Use /Jurisdiction</b>	
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	one quarter mile down dirt road
<b>Proximity to power</b>	on site
<b>Size (acres)</b>	8 acres
<b>General topography</b>	Relatively level agricultural land;
<b>General soil type</b>	Very fine soils on majority of site; gravels along river
<b>Erosion potential</b>	High wind erosion potential
<b>Flood potential and history</b>	Moderate
<b>Upstream land use</b>	Agricultural and irrigation diversion immediately upstream
<b>Water rights</b>	Unknown
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	Potential <b>1000</b> foot plus line from Dillon Ditch Company existing diversion structure; irrigation canal runs from diversion along site, which appears to be too low for gravity supply
<b>Groundwater evaluation</b>	N/A
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent-habitat</b>	Gravel bar extends well out into river along site except at very bottom end of site, next to bridge where a potential release ramp could be developed. Private property on upstream end of site has excellent potential release site.
<b>Anadromous fish</b>	Yes
<b>Upland habitat type</b>	Some cottonwoods and willows cover part of site with the remainder plowed bare soil.
<b>Wetlands</b>	No
<b>Permitting Considerations</b>	Water rights





Three Mile Dam

<b>DATE(S) VISITED</b>	1/17/91
<b>RIVER BASIN</b>	Umatilla
<b>SITE NAME</b>	Three Mile Dam (east bank, existing adult capture facility)
<b>SITE LOCATION</b>	
<b>County</b>	Umatilla
<b>Road Access Directions</b>	
<b>River Mile</b>	3
<b>USGS 1:100,000 Quad Ref.</b>	Pendleton, OR
<b>USGS 7.5' Quad Ref.</b>	Umatilla, OR - WA
<b>Section</b>	<b>Township</b>
<b>OWNERSHIP</b>	<b>Range</b>
<b>Owner Name</b>	ODF&W, CTUIR
<b>Contact Name</b>	Jim Phelps <b>ODF&amp;W</b> or Don Sampson, CTUIR
<b>Contact Phone</b>	(603) <b>276-2344</b> or (503) 2764199
<b>Zoning</b>	undetermined
<b>Land Use /Jurisdiction</b>	undetermined
<b>GENERAL CHARACTERISTICS</b>	
<b>Proximity to road</b>	adjacent to paved two lane road
<b>Proximity to power</b>	<b>3-phase</b> power at site
<b>Size (acres)</b>	2 - <b>3(approximate)</b>
<b>General topography</b>	flat, above river
<b>General soil type</b>	Alluvial
<b>Erosion potential</b>	Low
<b>Flood potential and history</b>	undetermined
<b>Upstream land use</b>	residential, commercial, agriculture
<b>Water rights</b>	undetermined
<b>WATER SUPPLY</b>	
<b>Gravity supply evaluation</b>	undetermined
<b>Groundwater evaluation</b>	undetermined
<b>ENVIRONMENTAL CHARACTERISTICS/CONSTRAINTS</b>	
<b>Adjacent stream habitat</b>	Pool above dam
<b>Anadromous fish</b>	present below site, none above until <b>Westland</b> diversion
<b>Upland habitat type</b>	
<b>Wetlands</b>	channels with riparian vegetation below ladder
<b>Permitting Considerations</b>	